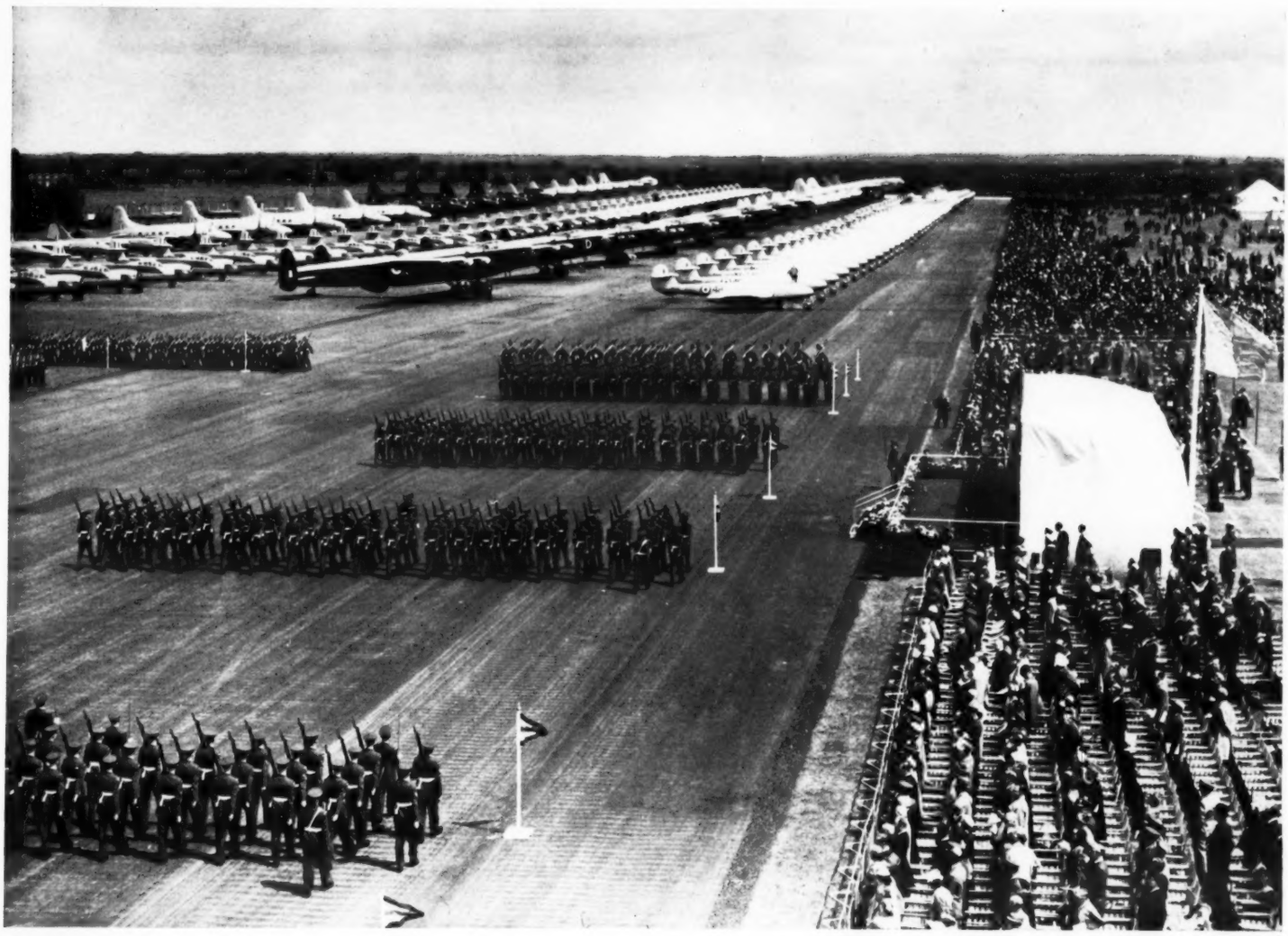
INTERAVIA

REVIEW OF WORLD AVIATION



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VOLUME VIII 9 1953

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Design and production of aircraft, engines, propellers

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INTERAVIA

Review of World Aviation

Volume VIII — No 9 — 1953

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Symbol of Britain's growing air power : The Queen's Review of the Royal Air Force at R.A.F. station Odiham on July 15th 1953.

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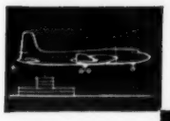

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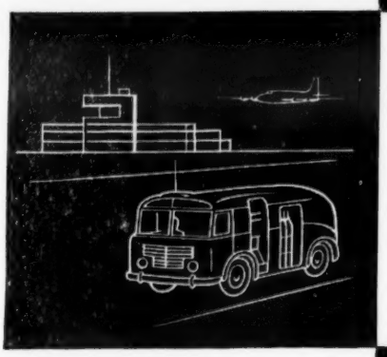

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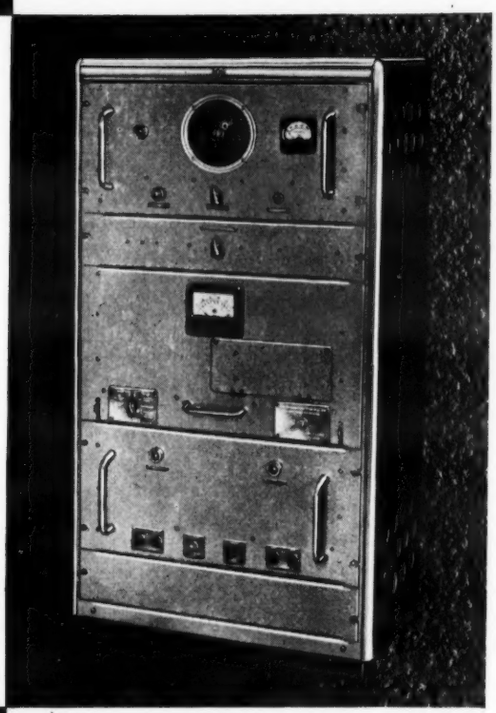

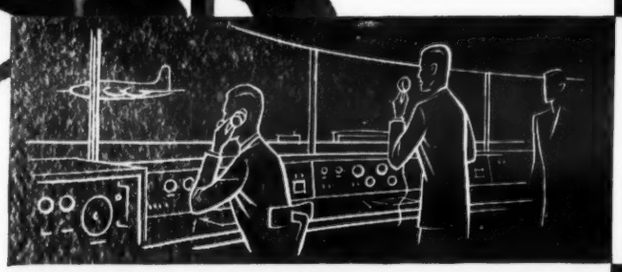

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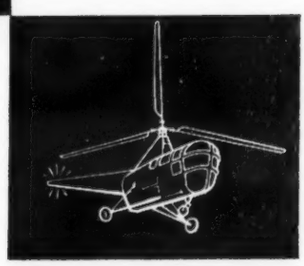

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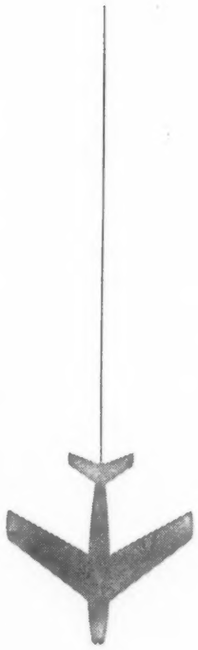

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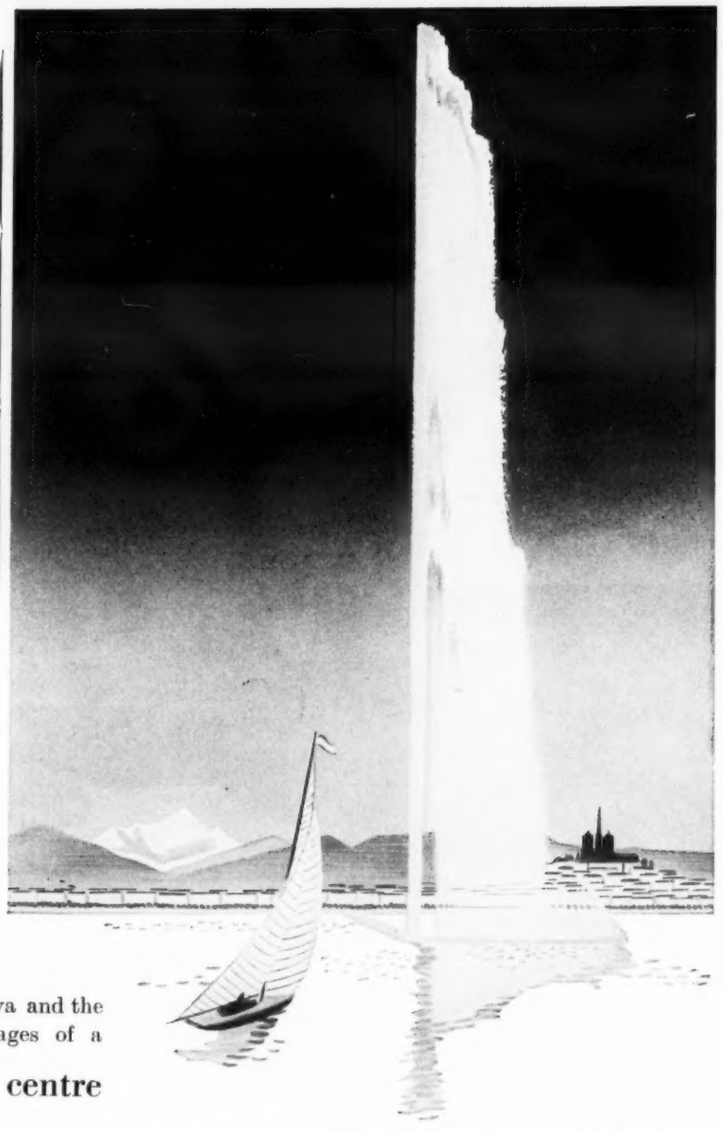

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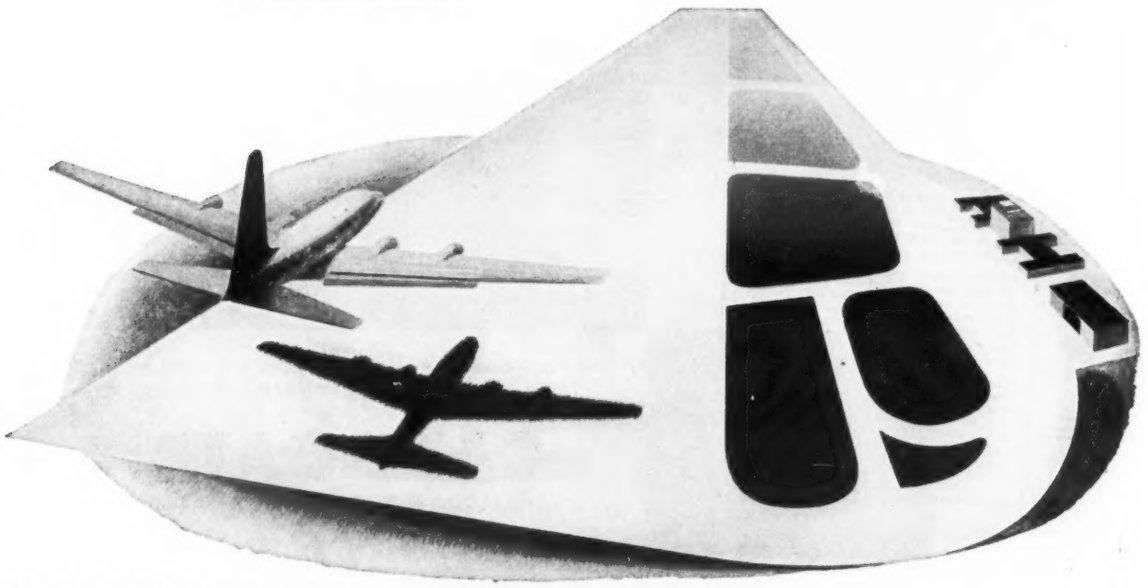

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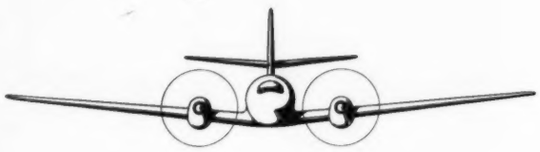

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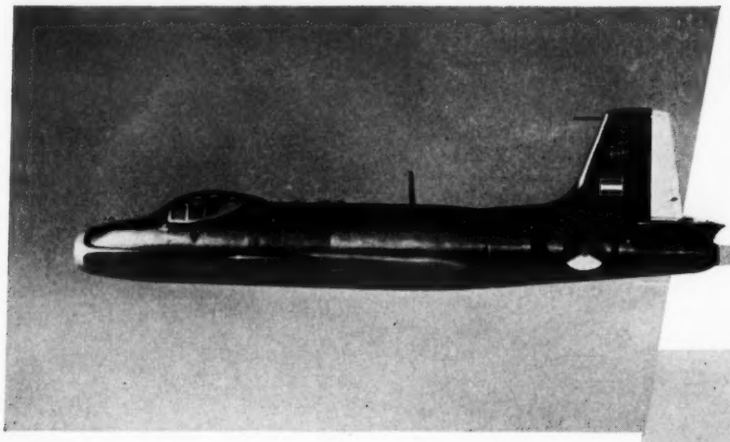

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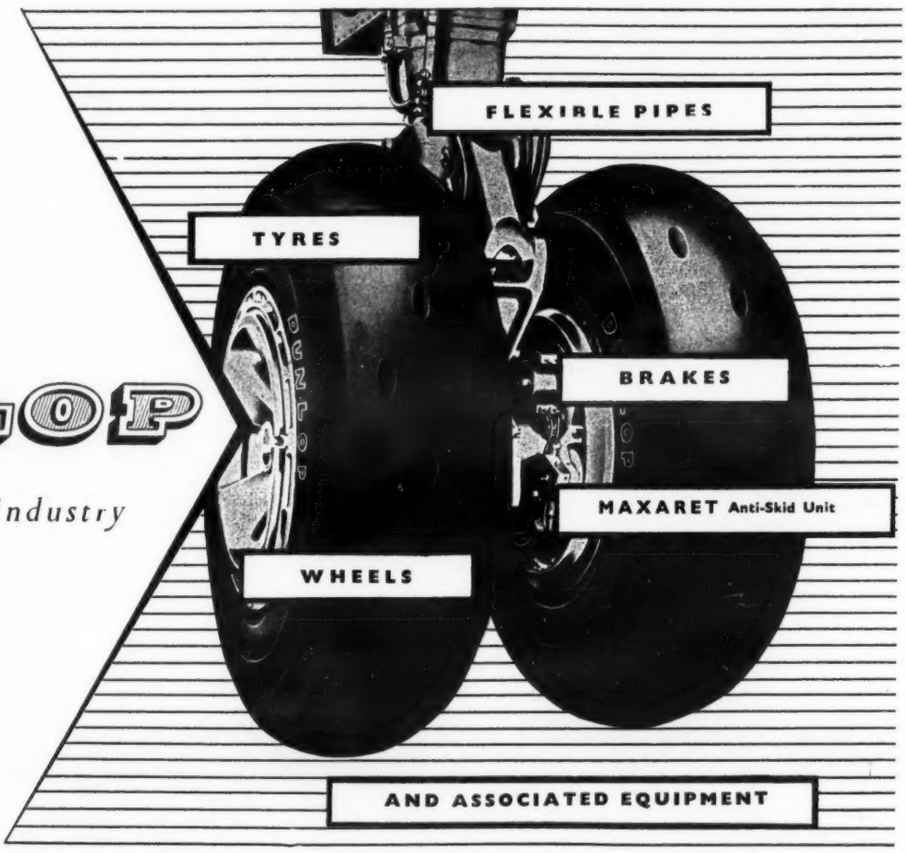

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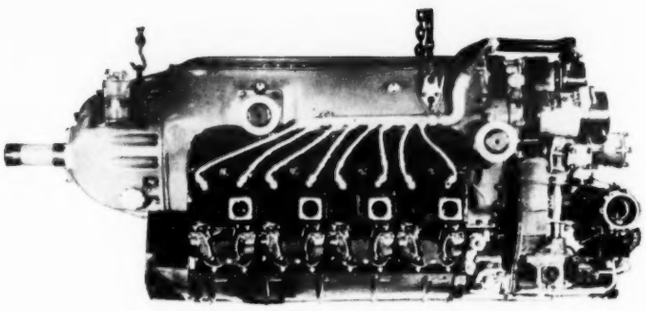

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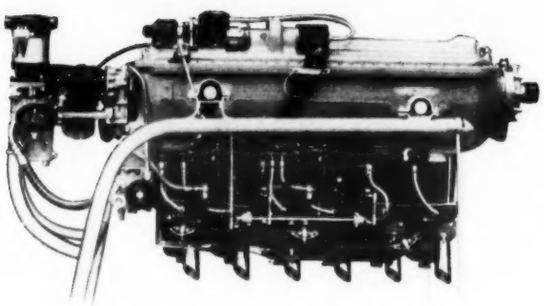

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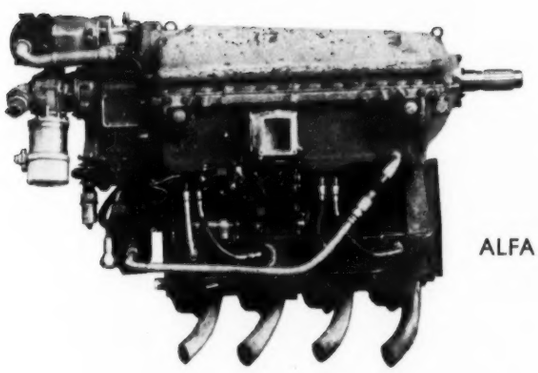

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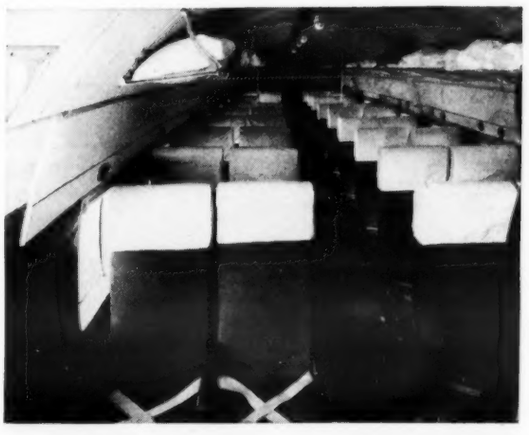

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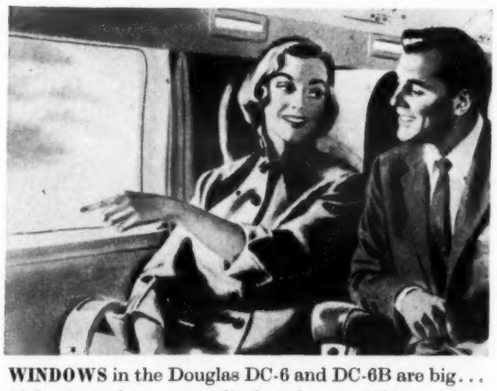

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INTERAVIA

Deadline Notes

No. 9/1953

BRITISH BASES IN LIBYA

A twenty-year treaty providing for British economic aid to Libya and the establishment of British bases in the new African kingdom was signed in Benghazi on July 30th. Britain will pay Libya £7,750,000 over the next five years and in return is allowed to maintain British forces in Libyan territory.

SOVIET DEFENCE BUDGET FOR 1953-54

The 1953-54 Defence Budget submitted to the Supreme Soviet by Finance Minister Zerev on August 6th provides for a total expenditure of 530,500,000,000 roubles, including 110,200,000,000 for defence purposes, which represents a cut of 3,600,000,000 roubles. The Soviet Budget contains additional military appropriations under different headings.

SWEDISH AIR FORCE APPROPRIATIONS FOR 1953-54

The Swedish Air Force submitted its 1954-55 estimates (July 1st, 1954, to June 30th, 1955) to Parliament on August 15th. No expansion of the day fighter squadrons is planned in the next fiscal year, though four of the ten new fighter wings projected under the 1948 air force expansion programme remain to be formed. Instead, new flying equipment is to be procured merely to complete the strength of existing units. - At the same time, the Swedish Air Force submitted its aircraft procurement programme under the 1954-61 Air Force plan. For 1954-55 it requests funds of Sw.Kr. 355,000,000 (1953-54: Kr.370,-000,000) for development and production of combat aircraft, Kr. 62,000,000 for jet engines, Kr.72,000,-000 for radar and radio equipment, Kr. 33,000,000 for ammunition and missiles, Kr. 9,000,000 for research and development, Kr. 18,000,000 for new transport aircraft.

GOOD BUSINESS FOR THE FLYING TIGERS

The Flying Tiger Line, one of the large U.S. cargo carriers, has signed an agreement with Japan Air Lines under which the latter acquires the delivery rights of two Douglas DC-6A four-engined transports originally ordered by Flying Tiger Lines. Under this novel contract Japan will pay a "bonus" of no less than $1,200,000 to Flying Tigers, over and above the purchase price of the two aircraft. In return, the treaty will enable JAL to inaugurate its San Francisco-Tokyo service more than a year earlier than planned. - Northwest Airlines and Flying Tiger Lines have made an agreement under which Northwest will lease four of Flying Tiger's Douglas DC-6A's for a period of seven years for the sum of $2,200,000 per aircraft. The aircraft remain the property of Flying Tiger Lines.

RICKENBACKER WITHDRAWS E.A.L. PRESIDENCY

Captain Edward Vernon Rickenbacker, well-known U.S. aviation pioneer, General Manager of Eastern Air Lines since 1934 and President since 1938, on August 10th announced his decision to resign from the presidency of his company. Rickenbacker, who will be 63 on October 8th, has been elected Chairman of the Board of the company. Thomas F. Armstrong, Vice-President and Secretary-Treasurer since 1938, succeeds him as President of E.A.L.

INTERNATIONAL HELICOPTER SERVICES ?

The Director of the Railway Administration in Southern Sweden, H. Markland, has submitted a plan to the Swedish railway authorities calling for a helicopter service between Malmö and Copenhagen. The heliports in the two cities would be installed on the roofs of the central railway stations. The service would be operated jointly by the Danish and Swedish railways and Scandinavian Airlines System.

* From INTERAVIA's world-wide news service, including **INTERAVIA AIR LETTER**, the daily international aviation news digest. — No part may be reproduced without written permission.

ATLANTIC MASS FLIGHTS, YESTERDAY AND TODAY

1933: Savoia-Marchetti Flying-boats

Twenty years ago a formation of 24 Savoia-Marchetti S.55 flying-boats commanded by Italo Balbo flew across the Atlantic from Orbetello to Chicago and later returned to Rome. To celebrate the 20th anniversary of the flight a reception was held at the U.S. Embassy in Rome, attended by top NATO personalities, officers of the Italian forces and the builders of the aircraft and engines (Isotta-Fraschini) that accomplished the flight.

1953: Thunderjet Fighters

During the night of August 21st, seventeen of twenty Republic F-84G Thunderjet fighters crossed the Atlantic non-stop and landed at the USAF base of Lakenheath in Britain. The aircraft had started from Turner Air Force Base, Georgia, and covered the Great Circle Route in 11 hours 30 minutes. Although all twenty aircraft had been refuelled in flight by Boeing tankers, three of the fighters had to land at the U.S.A.F. base of Keflavik, Iceland.

LOCKHEED COMMERCIAL ORDERS

Lockheed Aircraft Corporation reported a backlog of commercial orders at the end of the first half of 1953 of 86 Super Constellations valued at nearly $150,000,000. A year earlier, 69 aircraft of the same type had been on order.

FOKKER BRANCH WORKS IN BRAZIL

On August 8th, the Dutch Fokker Aircraft Company and the Brazilian Government concluded an agreement according to which the Dutch company will build jet and piston-engined aircraft in Brazil. The initial production programme includes the following: 100 Fokker S.11 and 50 S.12 Instructor trainers, 50 S.40 Mach Trainers. Total value of the contracts, approximately 400,000,000 Cruzeiros. The name of the new company is "Fokker Industria SA do Brasil".

WORKSHOP BRIEFS ...

First details of the Douglas X-3 high-speed experimental aircraft may shortly be released by U.S. security. Officially it has merely been announced so far that the type has been undergoing tests at Edwards Air Force Base for some time. * A civil version of the Lockheed C-130 turboprop transport could be operated at a cost of 4 cents per ton-mile; however, price of the civil C-130 would then be between $1,500,000 and $2,000,000, even if substantial military contracts precede civil orders. * For the U.S. Navy, Lockheed is equipping two P2V Neptune long-range patrol bombers with auxiliary Westinghouse J-34 jet engines. * The Convair XF2Y-1 Sea Dart hydro-ski-equipped twin-jet delta wing aircraft required about 40 seconds to take off in the course of demonstration flights at San Diego. * The new Ryan XM-21 target aircraft is powered with a Fairchild J-44 turbojet and, for take-off, with a rocket motor of unspecified type. * The North American FJ-3 Fury single-jet swept-wing naval fighter has started its flying trials; power plant, Wright J-65 Sapphire of 7,200 max. thrust; top speed, 700 mph-plus. * Two new photo reconnaissance versions of the Boeing B-47 Stratojet six-engined bomber are the RB-47E and the RB-47B. The two types have been developed to supersede the Boeing RB-50. * The SAAB S 29 C, prototype of a reconnaissance version of the SAAB J 29 fighter of Svenska Aeroplan AB, has started its flying trials. A production order for the S 29 C has been signed and initial deliveries are expected shortly. * Fokker's F.27 Friendship twin turboprop commercial transport, which normally accommodates 20 passengers, can carry up to 40 passengers on short range tourist services. * The Argentine Instituto Aerotecnico de Cordoba has completed the prototype of the I.Ae.35 light transport and feeder liner (two I.Ae.19 engines of 650 hp each). * A prototype of the Piaggio P.149 four-seater personal and training aircraft has started its flight tests at the airfield of Villanova d'Albenga; the Piaggio P.150 two-seater trainer has completed its type tests.

* * *

Background to Farnborough

14th S.B.A.C. Display, September 7th–13th, 1953

In September, 1952, *Interavia Review* introduced its preview of the 13th S.B.A.C. Display with a remark to the effect that the Ministry of Supply and the British aircraft industry were unable to come to an agreement until the eleventh hour on what new aircraft, engines and equipment might be shown to the public. Security regulations do not seem exactly to have made it easy to prepare the Display. That it was nevertheless a complete success is a tribute to the far-sighted planning of the individual British firms and to the organizing ability of the *Society of British Aircraft Constructors*.

What is the position this time? This year's preview has been written by our new English correspondent, *Derek H. Wood*. It shows that once again the curtain for the 14th S.B.A.C. Display will not be raised until the official opening. Nevertheless, *Interavia Review* believed that it would be useful to give a brief outline of the aims pursued in rearming the Royal Air Force and the Fleet Air Arm. The picture is completed by a review of the development and production programmes of the British airframe and engine manufacturers.

Every year since the end of the war, the British aircraft industry has endeavoured to show that Britain is first in the air. For this purpose Farnborough has been made an annual gala event—for was it not to demonstrate to the taxpayer what he was getting for his money and at the same time to make an impression on the rest of the world?

Quantity production is now well under way in certain sectors of the industry, particularly where fighter aircraft are concerned. The "V" bomber programme, too, seems to have excellent prospects. In these respects Farnborough seems assured in advance of renewed success.

Another question will be that of exports, for it will be impossible to see clearly until after Farnborough whether British exports are continuing to describe an upward curve. It cannot be overlooked that this hitherto very successful currency-earning branch of the British economy has of late been encountering certain difficulties, the causes of which are various. On the one hand, N.A.T.O. discussions during recent months have made it clear that some European countries, such as Italy and France, are turning away from producing British types under licence and are going over to either American models or else designs of their own. The Paris Air Show in June and July of this year also proved that the French aircraft industry is beginning to regain its independence and to cast loose from Britain's leadership in order to proceed under its own steam. And once rearmament begins in Western Germany, it will probably do so in relatively close cooperation with the United States and will not yield the British industry the income which it had reason to look forward to some twelve months ago.

None of this, however, alters the fact that the cream of the Rolls-Royce, Hawker Siddeley Group and Bristol products will retain their undisputed claim to a place in the world markets. However, the export sales of *Comet* jet transports, which were making a promising beginning a year ago, seem to have slowed down considerably, at any rate until enough experience has been gained to enable the efficiency and economy of this pioneering design to be properly assessed.

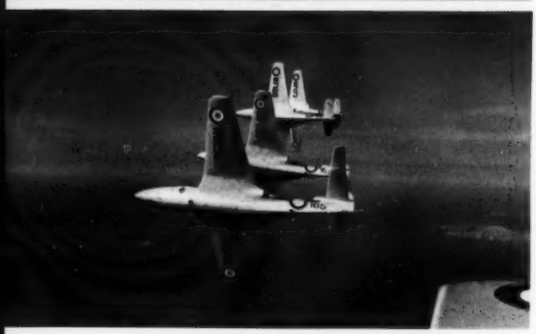
THE EDITORS

H.M. Queen Elizabeth reviews the Royal Air Force at Odiham A.F. Station on July 15th. (Photo : British Crown Copyright.)

The R.A.F. Coronation Review of July 15th was the largest review ever organized by the R.A.F. Nearly 1,000 aircraft took part in the static review and the fly-past. The number is indicative of the progress of British air rearmement. (Photo : British Crown Copyright.)

The standard British jet bomber now in squadron service is the twin-engined English Electric *Canberra*. Considerably over 100 have been delivered to combat units. (Photo : British Crown Copyright.)

Up—and up—and over . . . R.A.F. de Havilland *Venom F.B.1* fighter-bombers of the Allied Second Tactical Air Force, based at R.A.F. station Wunsdorf, Germany, starting a formation loop.



The first squadron of Hawker *Sea Hawk F.1* fighters to go into service with naval aviation (during 1953). The unit is shown flying over the Isle of Wight.

Farnborough

Britain's Air Power Today

"For good or ill, air mastery is today the supreme expression of military power." These words—by Winston Churchill—epitomize the defence policy of the British Government.

To an outsider, this assertion may come as a surprise, for the Royal Air Force still lacks swept-wing fighters, guided missiles and other ultra-modern equipment, and British naval aviation is only just beginning to emerge from the post-war doldrums. It is important to note, however, that Britain's aerial rearmament effort aims not only at preparing for the war which might occur today, but rather at the war which might break out tomorrow.

Thus, Britain's aerial rearmament programme will move through three phases, the first of which is now approaching completion. They are :

1. Expansion of operational units to their full strength and their equipment with jet-propelled aircraft (some of which admittedly are of obsolescent types).

2. Introduction of new and powerful jet fighters and bombers, together with interim types of guided missiles.

3. In a more remote future, conversion to "push-button warfare" by the introduction of a variety of guided missiles, as well as the few types of specialized piloted aircraft still required.

*

The major brake on the air rearmament programme adopted following the outbreak of war in Korea has been the lack of money and the reduced state of the aircraft industry. Geared down to building experimental aircraft and prototypes since the end of World War II, and with only limited funds available for quantity production, it found itself unable to meet the gigantic demands of the expansion programme.

The subsequent drastic pruning of the order book, plus the relief given by the "Super Priority" scheme, has meanwhile resulted in an industry with far better prospects of long-term stability. The labour force has grown steadily from 149,000 in June 1950 to over 210,000 now.

Several stumbling blocks—such as long development periods—remain to be overcome, but as a result of Government and off-shore procurement orders, military aircraft production is steadily approaching a high degree of efficiency.

THE R.A.F. COMMANDS

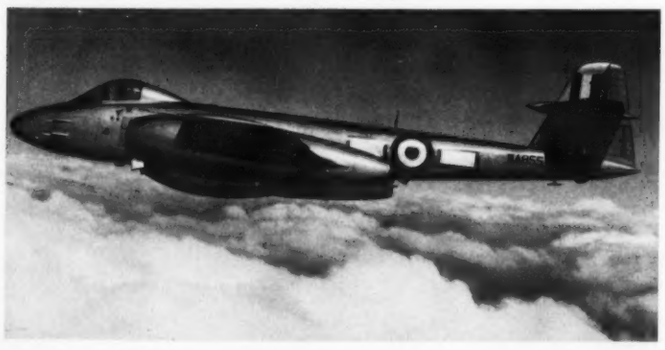
Fighter Command is *still* facing the age-old problems of the very high-flying and the very low-flying raiders. Most of the day interceptor squadrons continue to have the *Meteor Mk.8*, a type which obviously is outdated today, since it was designed in 1941.

Far too little credit is given the *Venom 1* for its interception abilities, and it is mostly considered as a pure ground attack machine. The *Venom* has a rate of climb comparable with that of the MiG-15, and at high altitude its powers of manoeuvre are exceptional. In the near future, deliveries of Canadair-built North American *Sabres* are scheduled to begin. The *Sabre* suffers from its low rate of climb, but this is more than compensated for by its superior speed and good handling.

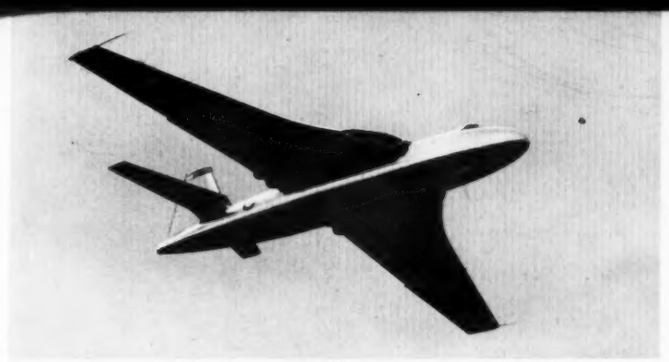
There have been delays in production of the *Hunter* and the *Swift*. However, the wide sub-contracting scheme that has been arranged will shortly produce the new jets in large numbers. The *Swift* version for squadrons is the *Mark 4* with compound wing taper, and this will be in use later in the year, to be followed early in 1954 by the *Hunter Mark 1* and *Mark 2*.

There is still a crying need for all-weather fighters, and squadrons must await the es-

Still the most widely used R.A.F. fighter is the Gloster *Meteor F.8*, now admittedly an obsolescent type. The aircraft here is from No. 1 Squadron.



The Vickers-Supermarine *Attacker* is still the Navy's standard jet fighter but is now being succeded by the *Sea Hawk*. Here it is armed with four 20-mm cannon plus 12 ground attack rockets. Note ventral tank.



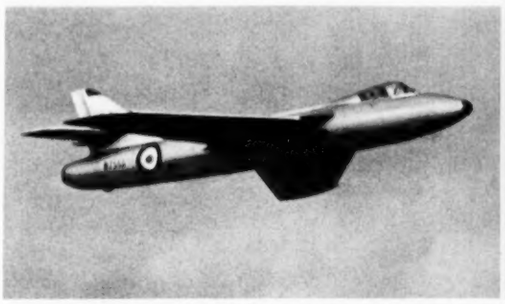
Two of the "V" bomber trio. *Left :* the Vickers *Valiant* four-jet bomber. This is in Super Priority production. *Right :* the Avro *Vulcan* delta-wing bomber, in limited production for comparative service evaluation tests with its radical rival, the H. P. *Victor*.

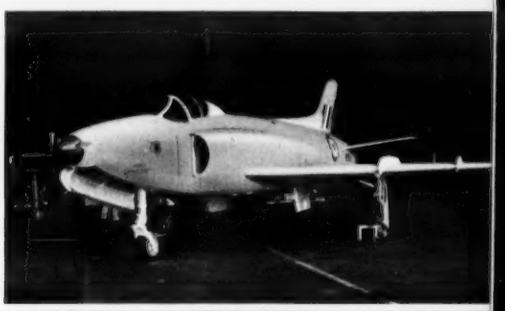
tablishment of the *Javelin* production line to replace the *Venom NF.2* and the even slower *Meteor NF.11*. Due to its radical design the *Javelin* has had a long period of gestation. Nevertheless, 1954 should see production machines available to form a squadron. Other all-weather designs of a different type are in the project stage but cannot be available for several years.

Bomber Command is a revitalized force ; anyone visiting a *Canberra*-equipped station immediately senses a new efficiency and enthusiasm—both lost in the lean post-war years when *Lancasters* and *Lincolns* were the standard equipment. A hint of growing jet bomber strength is the fact that all seventy B-29 *Super Fortresses* (R.A.F. *Washingtons*) loaned by the U.S.A.F. are now in process of being returned. It is quite obvious that over 100 *Canberras* are now in service, and with this aircraft Bomber Command have amused themselves during exercises by keeping out of reach of the defences on their sorties.

A potential enemy will find that his problem of intercepting British bombers will become even greater when the "V" trio, the *Valiant*, *Vulcan* and *Victor* four-jet bombers, is operational. These aircraft represent a bombing concept in which each aircraft, fitted with complex radar and carrying guided missiles and possibly the atomic bomb, is a force on its own and as such can wreak great havoc.

Coastal Command is now in a position to discharge its long-range overwater patrol duties. Its *Shackletons* are the first aircraft designed specifically for the job—the old practice was to convert any bomber that was available. For similar duties the flying boat is still being studied, and one day the R.A.F. may again do some of its ocean patrol work with long-range flying boats.





The new generation of British fighters. *Top left :* the Hawker *Hunter* will go into squadron service early in 1954 ; *top right :* the Vickers-Supermarine *Swift Mark IV* at present is the apple of the R.A.F.'s eye. Squadrons will begin re-equipping with the *Swift* later this year ; *lower left :* the Gloster *Javelin*, deliveries of which are to start in 1954 ; *lower right :* the Royal Navy is said to be interested in a special version of the de Havilland D.H.110.

Transport Command, which has been the R.A.F.'s Cinderella for some time, has new hope in the shape of the four-jet Vickers 1000 transport now under development. In training too, a change is becoming apparent. There are at present many types in service, the majority of which are piston-engined. For the next generation of fighter pilots, however, the scheme will be different. The trainee will be put on to piston-engined basic trainers, then an advanced jet trainer and finally the dual trainer version of the operational type he is to fly. In time he will even start his initial training on jets such as the *Viper*-powered Percival P.84.

NAVAL AVIATION

Since 1945, the Fleet Air Arm has had to do the best it could with a motley collection of outdated aircraft which have created acute training and spares problems. A re-definition of the duties of the naval air arm and plans to prepare the service for these duties are beginning to show results.

In future the Fleet Air Arm is to undertake three duties : *a)* antisubmarine warfare, *b)* air defence of warships at sea and of convoys, and *c)* carrier-borne strikes against land and sea targets.

The third of the "V" bombers : the Handley Page *Victor* scimitar-wing type.

The current generation of transports : the Vickers *Viscount* is in service with B.E.A., will shortly also go on the routes of foreign operators. This one is in Air France "dress."

Farther off still are deliveries of the Bristol *Britannia* turboprop airliner, two prototypes of which have been completed.

Deliveries of *Comet Mark 2* airliners (R.R. *Avon* jets) will begin later this year.

For anti-submarine search and strike, main reliance is placed upon piston-engined *Fireflies* as well as the *Avengers* and *Skyraiders* supplied from the U.S.A. through the Mutual Security Agency. The Fairey *Gannet,* which is now coming off the line, will be the major heavy carrier-borne anti-submarine aircraft ; it may later be complemented by a lighter type.

For the air defence of ships and convoys the Navy has as yet no supersonic interceptor. Her *Attackers* and *Sea Hawks* are in the 600 m.p.h. class, but a swept-wing day interceptor is badly needed. A heavy fighter for carrier work has been developed by Vickers Armstrongs from the butterfly-tailed Type 508, and its production has now been given the Super Priority classification.

Night fighting in the immediate future will be the duty of the *Sea Venom NF.20.* The Navy is showing considerable interest in the DH.110 as a potential successor to the *Sea Venom.*

So far there is no hint of a replacement in the pure strike category. At present the turboprop-powered *Wyvern* is coming into service and the first squadron has been formed.

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AIRFRAME INDUSTRY

Air Service Training Ltd. (Hawker Siddeley Group)

Although in its aircraft division this firm is mainly engaged upon experimental conversions, it has now produced a novel high-speed towed target which was shown for the first time at the Paris Salon.

Sir W. G. Armstrong Whitworth Aircraft, Ltd. (Hawker Siddeley Group)

On the design side, the Armstrong Whitworth works at Baginton, near Coventry, are mainly engaged upon missiles, but their production capacity is devoted to other Hawker Siddeley Group aircraft, the Sea Hawk and Meteor NF.11 and NF.13. *Meteor* night fighters have been supplied to the R.A.F. and to France and Denmark.

To make way for *Hunter* production at Kingston-on-Thames, the *Sea Hawk* naval fighter production line was removed to Baginton. Sea Hawks are now coming from the factory under M.o.S. and offshore contracts.

A *Hunter* line is being set up at Baginton and it is expected that the aircraft will be of the *Sapphire-powered* Mk.2 variety.

An Auster *Aiglet* trainer lightplane gives a demonstration of "one-wheeling" on and off the runway.

Auster Aircraft Ltd.

Virtually the only firm in Britain specialising solely in light aircraft, Austers have a range of high-wing personal, light transport and training aircraft which find a ready market both in the United Kingdom and abroad.

Current personal aircraft is the four-seater *Autocar,* while for civil or military primary training the *Aiglet Trainer* is being built.

Other types : *Auster B.4* ambulance/freighter prototype and the A.O.P. Mk. 9 (ex-Auster S), an army co-operation machine now in production for the British Army ; as well as the Auster T.7 and the A.O.P. 6.

Blackburn and General Aircraft Ltd.

Quantity production of the *Beverley* four-engined transport has been ordered, and the line is being set up at the company's Brough works. Compared with the prototype *Universal Freighter* it has modified rear fuselage and loading doors. The *Beverley* first flew on June 14th, 1953. Its civil version meets ICAO requirements and is on order for Silver City Airways as a three-deck car ferry. The *Beverley* spans 162 ft. and has an all-up weight of over 127,000 lb.

Blackburns are also building a series of Boulton Paul *Balliol* trainers under licence.

Boulton Paul Aircraft Ltd.

The *Balliol T.Mk.2* advanced trainer is now in regular use by the R.A.F. However, the decision to take pilots straight from primary on to jet aircraft has somewhat curtailed the R.A.F.'s use of piston-engined advanced trainers.

The company are continuing their research with delta-wing aircraft which will probably lead eventually to a high speed interceptor. Latest experimental to fly is the P.111A, the original prototype 111 with four rectangular section air brakes round the fuselage aft of the cockpit and internal modifications.

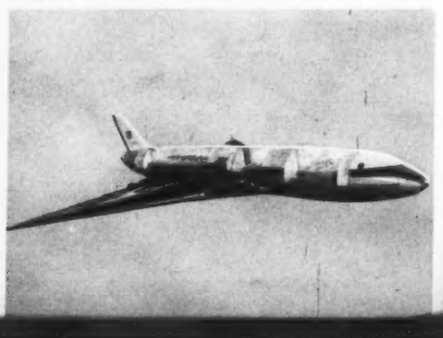
Boulton Paul also make power control systems for aircraft, electronic instruments, and gun turrets.

The Bristol Aeroplane Co. Ltd.

At their large Filton plant, Bristols are manufacturing aircraft ranging from the small multi-purpose Type 171 *Sycamore* helicopter to the big four-engined *Britannia* airliner.

Of the *Britannia*—contracts for about 50 have been placed or are being negotiated—two prototypes have been completed. Production will be facilitated by the decision to dismantle the two *Brabazon* aircraft, which will leave the *Brabazon* hangar available for the *Britannia*—a floor area of 7½ acres.

A new generation of large British jet transports is in the project stage. *Left :* the de Havilland *Comet 3* will be the first to appear. Reports claim that even this aircraft—though operational—will still be "experimental" : the "real goods" is expected to be its successor, the *Comet 4.*—*Centre :* the Vickers V.C.7 will be the civil version of the Vickers 1000 military transport. The prototype of the latter is under construction.—*Right :* the Avro *Atlantic* project has been developed from the *Vulcan* delta-wing bomber. Construction is unlikely to begin without a firm airline order.—Another jetliner project is the Handley Page H.P.97 scimitar-wing transport evolved from the *Victor* bomber.



Four versions of the *Britannia* are projected, the Mk.100 of B.O.A.C., and the Mks.200, 250 and 300 which are freight transport, mixed freight and passenger, and pure passenger aircraft, respectively. The later Mks. of Britannia are 10 ft. 3 in. longer than the type 100, have an all-up weight raised from 140,000 lbs. to 155,000 lbs., and are equipped with Proteus 750 turboprops of 4,150 e.h.p. each. Deliveries of these are expected in 1956/57.

An armed maritime reconnaissance version of the *Britannia* is planned. It is to be powered by Wright R-3350 *Cyclones* or Napier *Nomad* compound engines. At present under development at Canadair Ltd., this scheme expects to meet with the approval of and orders from the Royal Canadian Air Force.

The ubiquitous and tough twin-engined Bristol 170 *Freighter* remains in production.

In the rotating-wing field, Bristols are making a concerted bid to gain the "Bealine Bus" contract with their type 181 jet engined helicopter for about 50 passengers. Much experience for this will be gained on the 18-seater 173 Mk.3 with stub wings which will take about one third of the all-up weight and increase the cruising speed. Two 870 h.p. *Leonides Major* radials are scheduled to provide the power.

Major expansion at Filton during the year has been in the guided weapons establishment where a large design and production staff has been gathered. The company are continuing their development of ramjets and actual missiles.

The de Havilland Aircraft Co. Ltd.

By the beginning of September, the first production *Avon*-powered *Comet Mark 2* for B.O.A.C. will have flown, and further aircraft are well advanced on the line at Hatfield. Production of the *Comet 2* is also under way at the company's works in Broughton and at the Short Bros. factory at Belfast. Deliveries of *Comet* series 1 and 1A have been completed, and at Hatfield work continues on the prototype *Comet 3* which will seat 56 to 78 passengers over stage lengths up to 2,600 miles and have an all-up weight of 145,000 lb. The prototype *Comet 1* is already being used as a test-bed for the wing mounted fuel nacelles of the Mk.3.

In all, 54 *Comets* have so far been definitely ordered, and a number of series 2 and 3 are the subject of negotiation.

The *Dove* twin-engined light transport continues to bring orders and it is proving most popular, especially in the U.S.A. Some 450 *Doves* have been sold to over 30 countries. Its "big brother," the four-engined *Heron*, bids fair to prove almost as popular. Fifty *Herons* have been sold so far.

Latest versions of the *Venom* night fighter and the *Vampire T.11* trainer are fitted with a new clear-view canopy and ejector seats. The *Venom NF.2* is being delivered to the R.A.F. and will be followed by the NF.3 with improved radar.

At Broughton single-seat *Venoms Mk.1* are rolling off the lines, as are two-seat *Chipmunk* light trainers and *Vampire* trainers. *Vampire* fighters and trainers have now been delivered to 18 countries.

Flight testing is in progress under an M.o.S. development contract with the second proto-

First-Line Aircraft on Order for the R.A.F. and Fleet Air Arm

Manufacturer	Aircraft	Type	Power	Status
Royal Air Force				
Armstrong-Whitworth	Meteor NF.11 and 13	Two seat night fighter	2 Derwent	Gradual phasing out. Line to build Sea Hawk and Hunter.
De Havilland	Venom FB.1	Single-seat day fighter-bomber	1 Ghost	In large scale service and production.
De Havilland	Venom NF.2 and NF.3	Two seat night fighter	1 Ghost	In large scale production, now coming into service.
Gloster	Meteor F.8	Single-seat day fighter	2 Derwent	Phasing out, line to build Javelin.
Gloster	Javelin FAW.1	Two seat all-weather fighter	2 Sapphire	Large scale production soon. In service 1954-55. SP
Hawker	Hunter F.1 and F.2	Single-seat day fighter	1 Avon or Sapphire	Large scale production at 3 factories, much sub-contract. Due in service early 1954. Off-shore procurement order for U.K., 450 aircraft. SP
Vickers	Swift F.4	Single-seat day fighter	1 Avon	Large scale production. Wide subcontract. Coming into service late 1953.
Avro	Vulcan B.1	Medium bomber	4 Olympus	Small scale initial production. Facilities may be expanded later after evaluation alongside Victor. SP
English Electric	Canberra B.2	Light bomber	2 Avon	In large scale service and production. Later versions including Pathfinder on line. SP
Handley Page	Victor B.1	Medium bomber	4 Sapphire	Small scale initial production. Facilities may be expanded later after evaluation alongside Vulcan. SP
Vickers	Valiant B.1	Medium bomber	4 Avon	Medium production. Due in Squadron service early 1954. SP
Avro	Shackleton Mk.2	Long range reconnaissance	4 Griffon	Large scale production and in service. Replacing Shackleton 1.
Fleet Air Arm				
De Havilland	Sea Venom NF.20	Two seat night fighter	1 Ghost	Medium production; now coming into service.
Hawker	Sea Hawk F.1	Single-seat day fighter	1 Nene	Large scale production. First two squadrons formed. Off-shore procurement order for U.K.: 107 aircraft.
Vickers-Supermarine	?	Day fighter	2 Avon ?	Developed from Vickers 508. Swept wings; prototype constructed; line being built up. SP
Fairey	Gannet AS.1	Three seat anti-sub. search and strike	1 Double Mamba	First production flown. In service late 1953/early 1954. SP
Westland	Wyvern S.4	Single-seat strike	1 Python	Medium production. First squadron formed.

SP = Super Priority

First heavy utility transport to be ordered for the R.A.F. is the Blackburn & General Aircraft *Beverley*. Civil operators are also said to be interested.

The Boulton Paul P.111A experimental delta is continuing its flying trials.

The de Havilland *Sea Venom Mk. 20* fighter of the Royal Navy.

The Bristol Type 173 Mark 3 18-seater helicopter is the forerunner to the Type 181, contender for the B.E.A. "Rotorbus" contract (40-50-seater).

Farnborough

type DH.110 twin-engined all-weather fighter. De Havilland Propellers at Hatfield are testing and manufacturing guided missiles.

The English Electric Co. Ltd.

Production of the *Canberra* twin-jet light bomber at the Preston works has reached a high rate and the type is also in production at A.V. Roe, Handley Page, and Short Brothers in the United Kingdom, as well as in Australia and the U.S.A.

Standard squadron bomber is the *Canberra B.2.* Other versions are the PR.3 photo reconnaissance type and the T.4 trainer. Development is continuing, and the R.A.F. has a pathfinder mark on order.

English Electric are also actively engaged on a wide guided missiles programme. Finally, it

The Royal Navy's first production Fairey *Gannet* anti-submarine aircraft has now come off the line.

is constantly rumoured in the British press that the company is developing an all-weather fighter of radical design.

The Fairey Aviation Co. Ltd.

Major production effort by the Fairey factories at Hayes and Stockport is concentrated upon the *Gannet AS.1* anti-submarine aircraft powered by a *Double Mamba* turboprop. Admiralty modifications to the original specification (increased capacity for an extra radar operator) entailed some delay in manufacture.

Production difficulties have now been overcome, partly by the extensive use of envelope jigging developed by Fairey. The first production Gannet has flown, and the type is expected in squadron service early in 1954.

Two interesting lines of experimental development concern the Fairey VTO vertical take-off delta tested at Woomera, successor to the single-seater FD.1 experimental delta, and the *Rotodyne* helicopter. The 45 to 50-seater *Rotodyne,* another contender in the "Bealine Bus" programme, is to be powered by two Napier *Eland* turboprops. The Ministry of Supply has ordered a machine for experimental purposes.

Folland Aircraft Ltd.

Designer of the Canberra, W. E. W. Petter, now Managing Director of Folland Aircraft Ltd., contends that present plans for fighter rearmament call for aircraft that are too complicated and too expensive.

He has therefore designed a small lightweight fighter named the *Gnat,* of which two prototypes are under construction, and a full-scale highly detailed mock-up has been built (cf. elsewhere in this issue).

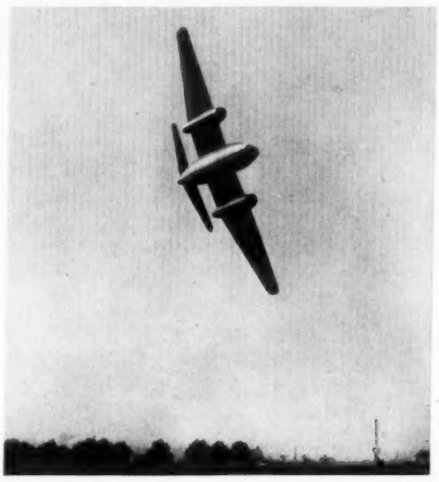
At present the *Gnat* is a private venture, but official interest, particularly in N.A.T.O., is growing.

The major stumbling block to development at the moment is lack of a suitable simple lightweight axial turbojet. The two prototype *Gnats* will probably fly with the Armstrong Siddeley *Viper* which, in ASV.6 form, delivers 1,900 lb. thrust.

Gloster Aircraft Co. Ltd. (Hawker Siddeley Group)

The Hucclecote works are at present phasing out the *Meteor* range of aircraft and building up the line for the complex twin-engined *Javelin* all-weather delta-wing fighter.

Testing of the third prototype is continuing (the first two crashed). Production aircraft will be appearing during 1954. One recent modification to the *Javelin* has been a slight increase of wing area.



The standard jet bomber of the R.A.F., the English Electric *Canberra B.2,* is being produced by English Electric, Shorts and Handley Page.

Handley Page Ltd.

At Cricklewood, London, Handley Page are developing the HP.80 *Victor* four-engined crescent-wing bomber and are completing a batch of *Canberra* bombers.

The *Victor* has been placed in limited production pending service evaluation alongside the Avro *Vulcan.* With the crescent wing, it is claimed that a high critical Mach number can be obtained, combined with good control over the whole speed range.

At Reading, deliveries are being completed of 30 *Marathon* crew trainers to the R.A.F. and the remainder of the *Marathon* batch laid down by the former Miles Aircraft Co. are being sold to civil operators.

Hawker Aircraft Ltd. (Hawker Siddeley Group)

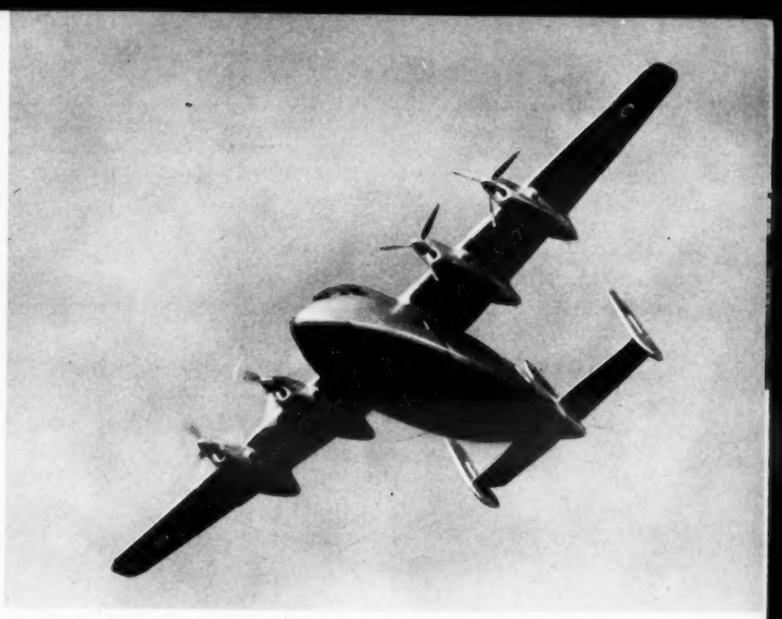
Starting producting of 450 *Hunters* under off-shore procurement orders and an undisclosed number under British order, the Hawker company have cleared their Kingston factory of the *Sea Hawk* naval fighter line, as mentioned previously.

Two marks of *Hunter* have so far been disclosed, the *Avon*-powered Mk.1 and the *Sapphire*-equipped Mk.2. Both types will be produced concurrently. In its production form the *Hunter* will have underwing drop tanks. First production *Hunter* has already flown, and the type will be in service early in 1954.

Some reports suggest that the firm may follow in the Hawker Siddeley tradition and produce a delta wing, whereas others claim that the project has already been abandoned.

The Hawker *Sea Hawk* naval fighter has now also been ordered for the Royal Navy under a U.S. off-shore contract.

Small transports : successor to the *Dove* light twin-engined transport, the D.H. *Heron* is becoming increasingly popular.



The Handley Page *Marathon* is being sold to civil operators. Thirty are being delivered to the R.A.F. in a special crew trainer version.

F. G. Miles Ltd.

With workshops at Redhill and Shoreham, F. G. Miles is rebuilding his aircraft business. He has completed the M.75 *Aries,* an improvement on his earlier light aeroplane designs, and is developing a jet version of the *Sparrowhawk* (two Turboméca *Palas* turbojets), and the M.76, which is a high performance glider constructed entirely of Durestos—a phenolic-impregnated asbestos material. At Redhill the firm also make large plastic radar scanner dishes.

Percival Aircraft Ltd.

The Percival *Provost* basic trainer is now coming into service with the Royal Air Force. Under development is the P.84, a *Viper*-powered jet trainer evolved from the *Provost*. Prototypes have already been ordered. Production continues of the multi-purpose twin-engined *Prince* for the Royal Air Force, Royal Navy and for civil use. The Navy uses it as a transport and trainer (the latter with radar nose) and the R.A.F. as a communications aircraft under the name *Pembroke*. Percival are also interested in the "Bealine Bus" specification and they have designed a helicopter with a high-set stub wing, conventional tailplane and single main rotor with wing-tip jet drive.

A.V. Roe & Co. Ltd. (Hawker Siddeley Group)

For R.A.F. Bomber Command, Avro are constructing an initial batch of *Vulcan* delta bombers for evaluation in service against the Handley Page *Victor* ; for Coastal Command, production of the *Shackleton Mk.2* is in full swing. Now in squadron service, this aircraft has improved radar equipment with a retractable belly radome scanning 360° in azimuth, a tail sighting position, and more powerful armament.

The *Vulcan,* designed to a specification issued as far back as January 1947, has been flying since August 1st, 1952, and, for test purposes, has had its four *Avons* replaced by *Sapphires.* A second prototype is well advanced. Production will be accelerated by the use of envelope jigging.—With its engines completely buried in the very low aspect ratio wing, the *Vulcan* is the antithesis of the American idea of high aspect ratios, thin wings and podded turbojets.

Avro now have five deltas flying : two 707As with root intakes, one 707B with dorsal intake, the 707C trainer with side-by-side seating and dual control, and the *Vulcan.* In the project stage is the Avro *Atlantic* which is based on the *Vulcan* and should be capable of flying non-stop London—New York in five to six hours, cruising at over 600 m.p.h. at 40,000 ft. and carrying 90 to 115 passengers. British Overseas Airways Corporation are no doubt interested in the stated operating costs of 10*d* per long ton/statute mile. The *Atlantic* would have a span of 121 ft. and an all-up weight of approximately 200,000 lb.

Saunders Roe Ltd.

Flight testing of one of the three 140-ton *Princess* flying boats is continuing. The others are cocooned at Cowes and await the arrival of their Proteus 3 engines. No decision seems to have been taken about the future of the type. In addition to extensive sub-contracts, Saunders Roe have advanced projects for supersonic fighter flying boats and long-range maritime reconnaissance flying boats with turboprops or compound engines.

Their helicopter division at Eastleigh was formed when the Cierva designs were taken over. The diminutive *Skeeter* has been evaluated by the Navy. Saunders Roe are another firm who are tendering to the "Bealine Bus" specification and their project is for a twin-rotor jet helicopter with stub wings.

Short Bros. and Harland Ltd.

A variety of work is being carried on at Belfast, Northern Ireland, with *Canberra B.2s* being delivered and 15 *Comet 2* fuselages taking shape.

In investigating new wing shapes Shorts first built an experimental glider which has been followed by the SB.5 experimental aircraft with variable wing sweep (adjustable on the ground) to an angle of 69°. Tests with maximum sweep are now in progress. Later the tailplane will be fitted on the fuselage underside, instead of above the fin.—According to American reports the company has designed a carrier-borne patrol aircraft known as the SB.6.

Orders continue to come in for the *Sealand* flying boat/amphibian (two *Gipsy Queen 70* engines) for 5 to 10 passengers or freight.

A Percival *Sea Prince* crew trainer in use by the Royal Navy.

R.A.F. Coastal Command's principal naval patrol and anti-submarine weapon—the big Avro *Shackleton Mark 2*, main characteristics of which are long range, relatively high speed and great carrying capacity.

swept-wing development of the type 508 for the Royal Navy. Squadrons will start re-equipping with the swift later this year.

Westland Aircraft Ltd.

First turboprop strike aircraft to go into regular carrier-borne service, the Westland *Wyvern S.4*, built at Yeovil, is now replacing the Blackburn *Firebrand*.

In the helicopter field Westland have built a number of S.51 helicopters under licence from Sikorsky, and are now shifting to the ten-passenger S.55. Their "Bealine Bus" project will be turboprop-powered, have small stub wings and a single main rotor.

Scottish Aviation Ltd.

While specializing in airliner conversions and modifications, Scottish Aviation have also designed the *Pioneer* and *Twin Pioneer* utility transports for operation from small airfields. A few *Pioneers* have been ordered for use on the Woomera rocket range in Australia.

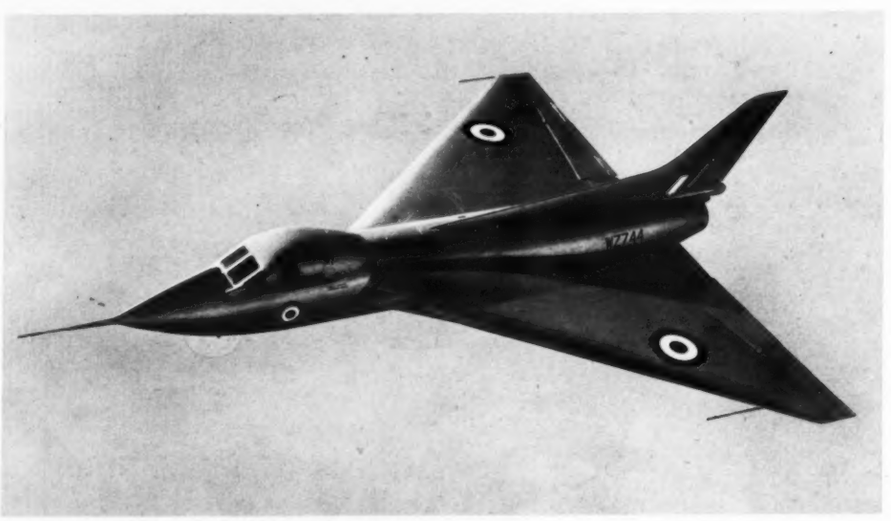
The *Twin Pioneer* project is for a 14 to 16 passenger high-wing fixed-undercarriage transport capable of operation from strips 100 yards long. Power would be two *Leonides* radials.

Vickers-Armstrongs Ltd.

Latest order for three *Viscounts* from Iraqi Airways brings the total for this turboprop airliner to 84, with many others being negotiated. Twelve of the B.E.A. *Viscounts* will be of the new 800 series with stretched fuselage, seating up to 82 passengers. Delivery of these is to commence in March 1955. Production of the *Viscount* is being transferred to the new Vickers base at Hurn, and the factory space at Weybridge is to be devoted to the four-jet *Valiant* bomber, first production versions of which are expected in service early in 1954.

Alongside the jet *Valiant* will be built the prototype Vickers 1000 R.A.F. transport, which will have *Conway* by-pass engines and a wing similar to that of the *Valiant*. Its civil version, the VC.7 is hoped to be suitable for both inter-city and trans-Atlantic operations. Seating capacity would vary between 100 and 150. Vickers, like most British aircraft companies, are also engaged in guided missile work.

The Vickers Supermarine works at South Marston are building two Super Priority fighters, the *Swift Mk.4* for the R.A.F. and the



The first delta-wing trainer : A.V. Roe's Type 707C.

AERO ENGINE MAKERS

Alvis Ltd.

For helicopters, transports and trainers, Alvis at Coventry continue to build the *Leonides* 500/570 h.p. radial and for future developments—particularly in the helicopter field—have built the two-row *Leonides Major* delivering 870 h.p. at 3,000 r.p.m.

Armstrong Siddeley Motors Ltd.
(Hawker Siddeley Group)

Since taking over the *Sapphire* in its early stages from Metropolitan Vickers, Armstrong Siddeley at Coventry have consistently raised the output and efficiency of their engine, for which the latest released figures (ASSa.6) are 8,000 lb. thrust for a specific consumption of 0.9 lb. hr./lb. thrust and a net dry weight of 2,600 lb. The *Sapphire* powers the *Javelin*,

Saunders Roe are continuing flying trials of the big 140-ton *Princess* flying boat.

The Saro *Skeeter* small helicopter has aroused the Royal Navy's interest.

The Westland *Wyvern S.4* turboprop-powered strike aircraft at present is the Navy's only modern type in this category.

Hunter 2 and *Victor,* and it is being licence-built in the U.S.A. as the Wright J-65.

The *Double Mamba* turboprop is in large-scale production for installation in the Fairey *Gannet,* and in its ASMD.1 form delivers 2,950 e.s.h.p. Development work on the single *Mamba* proceeds, and the latest Mark is the ASM.6. For the Westland *Wyvern* the *Python 3* turboprop has an output of 4,110 e.s.h.p.

Six versions of the Small *Viper* turbojet have been built, and these are in two forms : long-life (ASV.5) for such applications as the Percival P.84 and the *Gnat,* and short-life (ASV.3 or *Viper 100*) for the *Jindivik* pilotless target aircraft. Licence production of the *Viper* is being undertaken by Marcel Dassault in France. The pure jet adaptation of the *Mamba,* the *Adder,* has been built in limited quantity only for special applications.

Rocket motor development continues, and the company have built rockets with higher outputs than that of the *Snarler* which they installed in the tail of the *Hawker P.1072.*

Blackburn and General Aircraft (Engine Division)

In October 1952 the company acquired the exclusive manufacturing and selling rights for the French Turboméca gas turbines in the United Kingdom and most of the Commonwealth.—Light piston engines of the Cirrus *Bombardier* type continue in production and power such aircraft as the Saro *Skeeter.*

The Bristol Aeroplane Co. Ltd. (Engine Division)

With a 20 per cent reduction in weight and many internal refinements, compared with the early *Proteus,* the *Proteus 3* or *700* series turboprop is now coming into production and will equip the *Britannia* transport and the Saunders Roe *Princess* flying-boats.

Bristol's pure jet, the *Olympus,* has proved to be a very powerful and economical engine. With the two-spool layout of high and low-pressure compressors, the engine features easy starting with low power demand and rapid acceleration. Three versions of the *Olympus* have been disclosed, BO1.1/2B, BO1.1/2C and BO1./2A, the last with a thrust of 7,750 lb. This is well below the figure the engine was designed for and is in fact now giving. First application of the *Olympus* after its experimental flight testing in the *Canberra* will be on the Avro *Vulcan.*

The de Havilland Engine Co. Ltd.

The announcement by de Havillands of the existence of the *Gyron* turbojet has put an end to rumours which had been in circulation for months. The *Gyron* is understood to be a very large unit intended for a supersonic fighter and it is stated to be of low specific consumption, diameter and weight. No output figures have been released for the engine, which is designated DGy.1, but American papers have previously stated that it delivers 15,000 lb. thrust. Originally a private venture, the *Gyron* is now the subject of a Ministry of Supply contract.

At the D.H. Engine Company's factories the *Goblin* and *Ghost* single-sided centrifugal compressor turbojets remain in full production, the former for the *Vampire* Trainer and the latter for the *Venom,* and both units have been licenced to Sweden and Italy.

Test work on the *Sprite* liquid fuel cold rocket motor continues and a higher powered rocket motor, the *Super-Sprite* delivering 4,000 lbs. thrust, has just been announced.

D. Napier and Sons Ltd. (English Electric group)

This old-established engine firm has developed the *Nomad* compound Diesel engine and the *Eland* turboprop. In the *Nomad NNm.6,* weight has been reduced by nearly 1,000 lb. and length by 3 ft. 6 in. compared with the first *Nomad* seen at earlier Farnborough shows. The *Nomad* is a compounded Diesel engine and gas turbine, and for an output of 3,135 e.h.p. over a wide range of altitudes and speeds the consumption does not rise above 0.35 lb./e.h.p./hr.

Specified for certain "Bealine Bus" helicopter projects, the Napier *Eland* has an output of 3,000 e.h.p. for a weight of 1,575 lb. dry and a maximum diameter of only 26 $^{1}/_{16}$ in.

Rolls-Royce Ltd.

Equipping five Super Priority aircraft, the Rolls-Royce *Avon* has been steadily developed from 6,000 lb. thrust on the RA.2 to over 9,000 lb. thrust on the civil engine—stated to be the RA.16.

Avons are in production at Derby, East Kilbride in Scotland and also by the Bristol, Napier and Standard Motor companies. Licences have been acquired by the Hispano Suiza company in France, and the Fabrique Nationale in Belgium.

The Rolls-Royce *Nene* is still in production and powers the *Sea Hawk* and *Attacker,* etc. Its development, the *Tay,* is being built under licence in France and the U.S.A.

Short Brothers and Harland Ltd. are using the SB.5 experimental aircraft chiefly for testing various degrees of wing sweep—maximum is 69°.

The Rolls-Royce RCo.2 *Conway* by-pass engine bids fair to meet economic demands of short and long range civil aircraft—its applications in long-range military aircraft being obvious.

Another most successful Rolls-Royce design is the *Dart* turboprop which is fitted to the *Viscount.* The latest version, the RDa.5, delivers 1,640 s.h.p.

Piston engines from the Rolls stable, such as the *Griffon,* continue in production for military machines like the *Shackleton* and the *Firefly 7.*

Woomera
breaks the News Barrier

For several years "Woomera" has been synonymous with "top secret" or, as the Americans would call it, "cosmic secret." Woomera is the name of the giant Australian-British rocket range in the heart of the Commonwealth of Australia. In the past few weeks it has been in the forefront of atomic news, proving that Britain and Australia are jointly endeavouring to stay abreast of atomic weapons progress even without the help of the U.S.A.

On June 21st and 22nd of this year, the Australian press front-paged London news stories to the effect that the "biggest ever" atomic explosion would occur on the Woomera rocket range in 1954. As Prime Minister R. G. Menzies was in London at the time, it was up to the Acting Prime Minister, Sir Arthur Fadden, to reply to the "true or false?" questions put to him by Australian reporters. He got out of it by blandly replying, "No comment."

A similar London news story, at first officially denied, had broken the news of the first Anglo-Australian atomic explosion in the Monte Bello Islands two months in advance of its occurrence on October 3rd, 1952. Some credence was therefore given to the latest report, and one month later, on July 21st, Australian Supply Minister Howard Beale announced that Britain will shortly test an atomic bomb at the Woomera rocket range. Unofficial reports from London claimed that the bomb explosion will be the first of a series of at least six to take place between the early autumn of this year and the late spring of 1954. The component parts of at least three atom bombs had already been flown by R.A.F. *Hastings* transports from Britain to Australia; they would be used in the first of a series of "the most intensive atomic weapons experiments ever held."

Mr. Beale took this opportunity of throwing some light on Anglo-Australian collaboration in the testing of new weapons at Woomera rocket range. The British Government, he said, had asked the Australian Government in December 1952 to permit the first British atomic bomb test over land to be carried out in the South Australian desert. Britain had realized that the Monte Bello islands were an ideal site for the test of last October, but a land target would be needed later on. The target area would be located within the 80,000 square mile region which was a prohibited zone for testing war materials. The site selected was originally surveyed in 1950 by a reconnaissance expedition from Woomera. Atomic tests were not then contemplated, but the information obtained by the expedition led to the selection of the present target area. The region was typical red plain country, with salt bush, blue bush, spinifex and mulga scrub, and a solid base to take heavy aircraft landings. There were no aborigines on the range. Preparations for the bomb tests had been proceeding in close secrecy for some months. Transport aircraft were landing daily in the area with equipment and stores from Woomera . . .

Meanwhile, the Australian Commonwealth Gazette has published an announcement that the Woomera range and the surrounding area have been made a prohibited zone. "No unauthorized person shall enter or fly over the area or have in his possession any photograph, sketch, plan, model, article note or other document relating to anything in the area . . ." Penalty for infringement : seven years' imprisonment.

The headway which British firms have made in recent years in the development of "fantastic weapons" —guided missiles and A-weapons—is emphasized by the mushrooming branches of British aircraft firms in the "vicinity" of the Woomera range, i.e., at Salisbury, South Australia, 300 miles away from Woomera and only 16 miles from Adelaide. Recent additions to the list include English Electric, Bristol Aeroplane, Fairey Aviation, Armstrong-Whitworth Aircraft and General Electric Co. Ltd.

Between Monte Bello and Woomera there is a marked "social" distinction. Few Australians had ever heard of remote, foreign-sounding Monte Bello until the A-bomb brought the name into the news last October. Today, though the islands have gained a place in Australian and world history, there is still nothing but reports of an atomic blast to fix them in the lay mind. Woomera is different. The name itself, a familiar aboriginal word, helps the distinction which is created in part by the fact that the area of the range is the geographical heart of the Commonwealth and by the added fact that about 2,000 Australians live and work there. But more than that, ordinary people now have a factual picture, in broad terms at least, of what is going on there.

Development of the range dates back to 1947 when surveying and construction work began. Since then Australian expenditure has mounted to more than £A29,000,000. In the intervening six years a corner of the security curtain has been lifted just occasionally, to permit selected journalists to peep through and glimpse something of the work at the Long Range Weapons Establishment's base at Salisbury ; something of the vastness of the range itself and of the way those who people the Woomera base live ; and to hint at the shape of things to come. That was all—all, that is, until it was decided to pull the outer curtain of security right up.

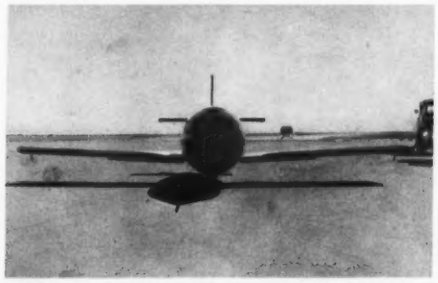
On May 2 last, before a battery of cameras and under the eyes of the representative Press, Prime Minister Menzies performed an official ceremony unique in Australian history. From a control point about a mile from the Woomera runway, he pressed a silver button and launched the *Jindivik* pilotless jet target aircraft, the pride of the design and production teams of the Government Aircraft Factories at Fishermen's Bend, Melbourne. Then, a 600 lb. test rocket, a part of LRWE's basic research equipment, was fired and, for good measure, the party was permitted to inspect a Fairey research model aircraft.

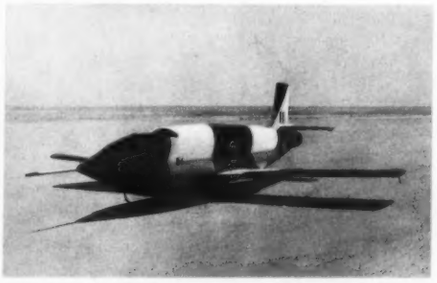
As a preface to the *Jindivik* flight, Supply Minister Beale explained that both Britain and the United States were very interested in the aircraft because, in many respects, it was unique. "There have been plenty of pilotless aircraft flown before, but none quite of this class and certainly not at this speed or with this type of landing device," he declared, and went on to praise Ian Fleming, "the very able engineer and designer of this Australian project."

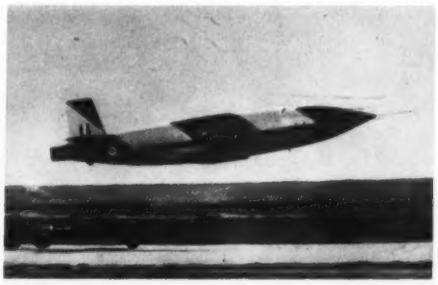
The launching of *Jindivik* and the experimental rocket gave away no secrets—understandably enough. What the demonstration really did was to emphasize the Government's consciousness of the taxpayers' right to know how their money was being spent, and it was, perhaps, no accident that it took place precisely one week before the country went to the polls to elect its senators.

Mr. Beale told the gathering that what they had seen was a "very small part indeed of a very great enterprise." American guided missiles experts (a special mission from the United States led by Brigadier-General E. P. Mechling, U.S.A.F., recently spent two weeks on the range) had complimented the Government on the economy with which it had spent its money on the Woomera establishment. The tempo of the range trials was increasing, he said. Since the beginning of 1950 about 700 rockets had been launched, 2,200 bombs had been dropped and 440 missiles "of other kinds" had been fired—nearly all of them containing the most modern scientific devices for recording behaviour and

Jindivik Mark I from the front, three-quarter front, and taking off from its launching trolley.







aerodynamic conditions. Data collated from these tests were being relayed constantly to Britain. Known as a rocket range, Woomera was, more than anything, an aircraft range. *Canberras, Lincolns, Super Fortresses,* and other aircraft—even a hard-working helicopter—had, between them, made sorties in which 2,500 hours of flying had been compiled.

Australian aboriginal glossary

Woomera	Weapon (spear) thrower
Pika	Flier
Jindivik	Carry nothing

In amplification of the Ministerial statements the background to the development of *Jindivik* was revealed in some detail. It covered a span of five years. In 1948 representatives of the British Ministry of Supply and the Australian Department of Supply conferred and from their meetings a specification for a small high speed, pilotless target aircraft was prepared. To reduce the overall development time, a piloted version was also planned. Design work began at the Government Aircraft Factories in mid-1948 and the first piloted aircraft, named *Pika,* made its first flight at Woomera in October 1950 with G.A.F.'s chief test pilot, J. B. Miles, at the controls. Two *Pikas* were built and these have accumulated almost 100 flying hours in checking general design characteristics, in proving the various components of the remote control system and, more recently, in developing new equipment.

The first pilotless version—*Jindivik*—was delivered to Woomera in November 1951. Its first flight was made in August 1952 and a series of successful flights followed. There has been some damage to aircraft but its performance is considered satisfactory in view of the novel nature of the project and the fact that unproved airframes, engines and equipment are all being tested simultaneously. In the current stage the designers are confident that they will achieve a very high percentage of success, though they are careful to recognize the possibility of failure through unforeseen circumstances or instrumental defect. Twelve *Jindivik Mark I* aircraft have been manufactured, all of them, in addition to the two *Pikas,* powered by Armstrong Siddeley *Adder* pure jet turbine engines, giving a maximum thrust slightly in excess of 1,000 lb. Most of their remote control equipment has been developed in Britain by the Royal Aircraft Establishment, Farnborough, in conjunction with the British instrument and electronics industry.

Design of a *Mark II* version is now virtually complete and the first of four prototypes is about to begin flight trials. Production of a further fifty of this version of the *Jindivik* is in hand, and enquiries for very much larger quantities are being examined. *Jindivik Mark II* has the same control equipment as the *Mark I* but is powered by an Armstrong Siddeley *Viper* pure jet turbine giving a maximum thrust of about 1,600 lb.

An Avro *Lincoln* bomber fitted with two A.S. *Python* turboprops and contra-rotating airscrews in the outboard positions, for high-altitude experiments.

Mark I was a reasonably conventional aircraft. *Mark II* has been designed to reduce production and maintenance costs. Metal bonding and other special processes are used and the structure has been planned to give ease of access to engine and equipment. The unusual landing gear has a single retractable skid which is lowered just before landing. For take-off the aircraft is automatically released, at pre-determined speed, from its tricycle trolley which, in turn, is guided by a gyro-control system, the brakes on its wheels being applied once the aircraft has been released. For flight control there is a radio link from either ground or airborne station. At the ground station the controller operates push buttons and switches to obtain any desired flight condition, and a telemetry link back from the aircraft gives him engine speed, air speed, height, etc. The aircraft is, of course, tracked by radar, and the track plotted on a chart beside the controller. A *Meteor Mark VII* two-seater is used as an airborne station, the operator in the rear seat having the same type of control box as the ground controller and receiving the telemetered information over the normal VHF ground/air radio link.

With a wing span of 19 ft. and a length of about 23 ft., *Jindivik* is about half the size of a *Vampire* fighter. Its speed and rate of climb are said to be comparable with values being achieved by high performance jet aircraft coming into service throughout the world.

The degree of cooperation and coordination between Britain and Australia in LRWE is expressed by the British "back room" work—detailed research and initial planning of projects, production of remote control equipment and so on—while Australia contributes research, aircraft design and production and, in the main, the facilities exemplified by the Woomera range itself. Linked with the British contribution is the work of the British aircraft industry. It happens that some publicity has been given to certain British firms while others have received none. The truth is that accomplishment is sometimes in reverse proportion to the publicity given. Security forbids a detailed list

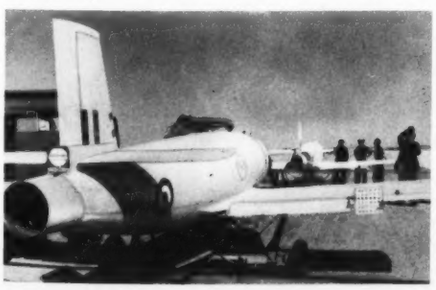
Aircraft on the hardstanding at the airfield of the Woomera Long Range Weapons Establishment in the South Australian desert include, from front to back, a *Pika* piloted experimental machine, a Gloster *Meteor VII* which is used to track pilotless aircraft, an Auster communications aircraft and a *Jindivik* pilotless aircraft on its take-off trolley.

of British organizations working in or planning to work in Australia. What can be said is that all major groups in the British aircraft industry that have a project relevant to LRWE are directly interested, though much of the planning is, as yet, only on paper. The pattern is that these firms produce prototypes, send them to Australia, test them, modify them and test again. It is certain that all such manufacturers will, in time, be fully represented at Salisbury or Woomera.

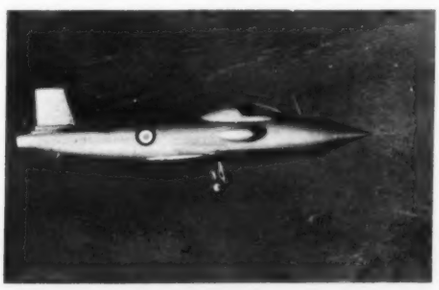
*

Meanwhile, the fact that Britain will hold a series of atomic bomb tests at Woomera emphasizes the way money can still be spent on duplication of effort in the free world. If closer cooperation with the U.S.A. were possible in the atomic energy field, there would be no lack of uses for the money saved. D.N.G.

Two *Jindiviks* radio-controlled jet aircraft being prepared for a flight at Woomera. (Photo, Courtesy of *Aircraft,* Melbourne.)



Pika in flight.



An English Electric *Canberra* at Woomera. The incredible flatness of the country is clearly evident.

The Truth about "Mainbrace"

BY VICE-ADMIRAL PIERRE BARJOT, PARIS

In the March issue of *Interavia*, Lieutenant-Colonel Pierre Gallois, of the French Air Force,[1] condemns the aircraft carrier on the basis of the results of *Exercise Mainbrace* held in the North Sea in September 1952.

Pierre Gallois is of course perfectly entitled to his own opinion of aircraft carriers. However, since his arguments are built up on data collected during an exercise, he should perhaps have taken a little more care to see that his facts were accurate. Certain points in his article call for rectification.

The following are the conclusions drawn by Pierre Gallois :

1. During *Mainbrace* bad weather nailed carrier-based aircraft to their decks, whereas shore-based aircraft were not immobilized by the atmospheric conditions.

2. Orange submarines "sank" four or five Blue aircraft carriers. (This piece of news was announced in a highly sensational manner in the British press by de Seversky as early as September 15th, 1952.)

3. The exercise demonstrated the "tremendous limitations" of a large fleet manoeuvring in narrow seas (300 miles wide) and obliged to refuel after three days, under difficult conditions.

4. Bomber Command and Training Command aircraft taking part in *Mainbrace* attacked the fleet of aircraft carriers without being detected in time. Land-based *Sea Hornets* had particularly distinguished themselves, and R.A.F. B-29s, bombing at night and through the clouds, "were counted as having dropped a heavy load of TNT on the carriers without the carrier-based fighters being able to intervene."

I shall reply point by point to these criticisms, basing my remarks on the detailed accounts given in *The Aeroplane* of October 3rd, 1952, and above all in the *United States Naval Institute Proceedings* of January 1953 ; since almost a year has passed and the security blackout on *Mainbrace* is now less severe, I shall add figures which I myself have been able to obtain in the meantime.

Comparison between shore-based and carrier-based sorties

Bad weather is said to have "grounded" the carrier-based aircraft on their decks, whereas land-based aircraft continued to operate. Here are the figures for the sorties made during the days of bad weather.

The aircraft carrier operation off Narvik took place on September 17th, 1952. The weather turned very bad towards the end of the morning, and flying was suspended after 11 a.m. Nevertheless, carrier-based aircraft succeeded in making 152 sorties. But the "enemy" air units, based on land, made only 36 sorties on that day. It should be added that, out of the 152 carrier-based sorties, 102 were for an attack on Bardufoss airfield, whereas *no attack* was made on the aircraft carriers by the air units based in Norway. The weather stopped all flying on September 18th, except for dropping supplies by parachute for the ground forces. To be fair, it must be stated that on September 17th and 18th the coastal bases at Trondheim and Sullum Voe (Shetlands) could themselves not be used by the naval aircraft, which could make no sorties at all.

In the operations off Denmark (September 21st to 22nd), also carried out in bad weather, carrier-based aircraft totalled 400 sorties, and the opposition land-based units only 140. Out of the 400 sorties from the flat-tops, 270 were directed against the three air bases at Karup, Skrydstrup and Vandel in Slesvig. There were no flights the next day, September 23rd, because of peacetime safety rules, which take precedence over all other considerations.

To sum up, a comparison between the sorties made by the land-based Orange air units and those of the carrier-based forces contradicts the statement that the bad weather favoured the land-based aircraft.

The submarines episode

Submarines are said to have sunk several aircraft carriers. The facts, placed in their true perspective, are as follows :

The episode reported by de Seversky occurred as the Task Force was leaving the Clyde Estuary on September 13th, right at the beginning of the exercise. A submarine was lying in wait when the fleet was still in the channel, before the aircraft carriers were operational.

[1] "Is the Flat-Top Doomed?" *Interavia* Review No. 3, 1953, pp. 134-137.

Despite bad weather, carrier-based aircraft made 400 sorties on September 22nd, 1952, in support of the "Blue" landing operation on the northwest coast of Jutland, compared with 140 sorties by land-based interceptors.

When a naval force is leaving port, responsibility for defence rests with the coastal air units. The submarine in question was actually detected twice, between 08.50 and 09.30 hours, by Coastal Command *Shackletons*. If therefore there was a failure here, it should rather be imputed to Coastal Command than to the aircraft carriers. The *Shackleton* attack on the submarine between 09.28 and 09.45 hours was recognized as successful, and later operations by this submarine against the Task Force that morning were disqualified. The "Complete Report on Mainbrace" in *The Aeroplane* of October 3rd, 1952, stated: "The submarine surfaced, supposedly acknowledging that it had been sunk."

In the later phases of operations against the land (Narvik and Jutland) there were only two submarine attacks, one against the main carrier task force on September 18th, and the other the same day against one of the two secondary task forces. This is quite normal and was in accord with the principles of the exercise. On the other hand, the number of submarines detected and attacked by carrier-based aircraft during the ten days of the exercise was 59.

The United States aircraft carrier *Franklin D. Roosevelt* (Midway class: 45,000 tons) belonged to the fleet of six carriers which was attacked by an "Orange" submarine lying in ambush in the Firth of Clyde, as it was running out for "Exercise Mainbrace."—A Grumman F9F *Panther* jet fighter preparing for take-off.

Refuelling at sea—a normal operation

The object of refuelling exercises at sea is to enable the fleet to avoid having to return to port. Refuelling at sea is therefore anything but a handicap, and a sailor cannot help smiling when he hears talk about the "immense difficulties" of refuelling a fleet in an "enclosed sea little more than 300 miles across." It is part of the sailor's normal job to refuel at sea. I need only add that this operation during *Mainbrace* did not provide an occasion for an attack by the opposing air forces.

Sorties by carrier-based and land-based aircraft

Bomber Command aircraft are supposed to have attacked the aircraft carriers "without being detected."

This statement is incorrect. The carriers' detection service worked perfectly. There were cases where the interceptor patrol was unable to engage the raiders, for example during the attacks on the Canadian aircraft carrier *Magnificent* by Royal Navy *Sea Hornets* on September 18th.

The Aeroplane of October 3rd relates that these *Sea Hornets* succeeded in approaching by using friendly IFF signals.[2] "They are not playing the game," complained one officer, according to this account.

On another mission the *Sea Hornets,* this time on the Blue side, attacked an Orange cruiser. This isolated cruiser was playing the part of a raider, and the aircraft carriers were in no way involved in the episode. But the affair is quoted by Lt. Col. Gallois as if it had been an attack on the carriers.

[2] Identification Friend or Foe.

The B-29 attacks against the aircraft carriers (quoted by Pierre Gallois) took place on September 17th. They were made from great height (18,000 ft.), with radar bombing through cloud. How accurate or effective they were is by no means clear. The account in *The Aeroplane* states that the vessels concerned were not aircraft carriers, but the Replenishment Group.

It may be added that the *Canberras* (Orange) from Binbrook, which took off to attack the aircraft carriers, lost their way in the bad weather, and it was only because of a chance encounter—not generally to be recommended—with the jet fighters from the carriers that they were able to find it again ("The Aeroplane," October 3rd, 1952).

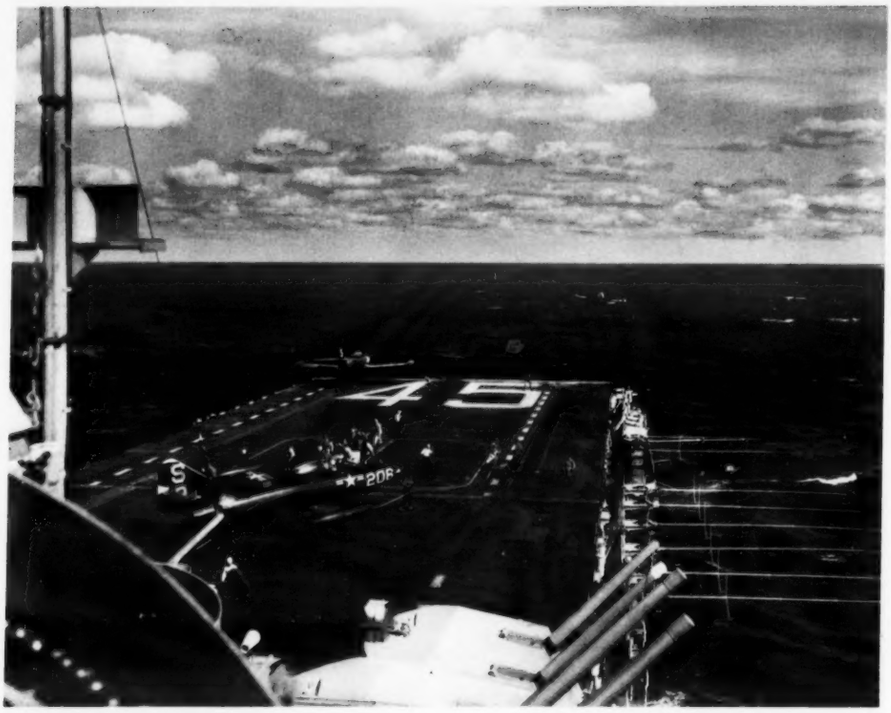
This detail shows clearly enough that the bad weather also hampered the land-based units.

Conclusions

It is not possible to draw valid lessons from any exercise on the basis of incomplete press reports and a pre-conceived theory.

1. If the submarines did well in Mainbrace, so much the better. We should never underestimate an adversary. Commanders at sea must simply manoeuvre better so as to defeat or avoid them. In exercise *Mainbrace* the Royal Air Force distinguished itself in the

Episode in the landing on Jutland.



Grumman F9F *Panther* jet fighters taking off from an American aircraft carrier of the *Essex* class.

anti-submarine battle, particularly the *Shackletons*.

2. Regardless of difficulties, the aircraft carriers were able to fulfil their mission on four days out of six, in spite of exceptionally bad weather conditions.

Under such conditions in wartime the carrier task force would wait twenty-four hours for better weather. In an exercise prepared in advance to a strict time-table it was inevitable that certain operations should be cut short or even eliminated to enable the programme to be kept. This peacetime subordination to a time-table does not mean that the operation would be impossible in time of war.

3. A number of criticisms were directed at the employment of certain carriers (Hanson Baldwin in the "New York Times" of September 28th). But an exercise is designed precisely to uncover such defects. In any case, as carrier technique is very specialized, it is better to have air admirals at sea rather than battleship admirals.

4. It is not correct to compare land-based air units constantly with carrier-based units. Both have their part to play and both are equally indispensable, especially in a narrow sea. If there have been times when a heavy swell has made deck landings difficult, there have also been occasions (for example in Korea) when runways have been snowed up and impossible to use, while the catapults of the aircraft carriers enabled them to continue to operate immediately the snow had been swept off the flight deck.

The aircraft carriers would be more useful in northern countries than is thought. We may recall that in April 1940 at the time of the invasion of Norway, Gloster *Gladiators* based at Bardufoss airfield, near Narvik, were unable to take off from the frozen runway and were destroyed on the ground by *Stukas*. It would have been quite different if they had been operating from a carrier. Personally I am convinced that the whole course of the Norwegian campaign would have been changed if the Royal Navy had had aircraft carriers *equipped with fighters*. But it had so often been said—in pre-war R.A.F. circles—that the results would not be worth the cost, since carrier-based aircraft would always be inferior in performance to land-based types. This theory almost lost the war for Britain—and consequently for France too. It is always bad to refuse *a priori* to use certain weapons, under the pretext that they belong to some other branch of the forces.

Modern warfare demands the combined use of both land-based and carrier-based air units, under the navy and the air force, since they complement each other. *Mainbrace* showed that both are required. This is the true lesson of the exercise.

The British aircraft carrier *Eagle* (*Ark Royal* class : 46,000 tons) running into Oslo after N.A.T.O.'s "Exercise Mainbrace." On deck a squadron of Supermarine *Attacker* carrier-based jet fighters.

Distribution of aircraft carriers in Exercise Mainbrace

1. **Carrier task force** (Striking force) = 6 aircraft carriers (Vice-Admiral Stump, U.S.A.)
   - MIDWAY, F. D. ROOSEVELT, WASP — Rear-Admiral Doyle (U.S.A.)
   - EAGLE, ILLUSTRIOUS (G.B.), WRIGHT (U.S.A.), fast aircraft carriers — British rear-admiral
2. **Force 171** = 3 aircraft carriers (support force)
   - THESEUS (G.B.), MAGNIFICENT (Canada), MINDORO (U.S.A.) — British rear-admiral
3. **Force 173** = 2 aircraft carriers (Hunter-Killer Group and defence for *Under way replenishment force*)
   - SALERNO BAY (U.S.A.), TRIUMPH (G.B.) — American rear-admiral

Total : 6 American aircraft carriers
4 British aircraft carriers
1 Canadian aircraft carrier
11 aircraft carriers, with 500 aircraft

Old and new : North American *Harvard* trainers flying in formation to mark the Royal Netherlands Air Force's 40th birthday.

N.A.T.O. over Holland

As part of the celebrations in honour of the 40th anniversary of the Royal Netherlands Air Force, a N.A.T.O. Air Display was held on July 18th at the oldest Netherlands Air Base, Soesterberg, the birthplace of the Dutch Air Force in 1913.

The air display, which was watched by H. M. Queen Juliana, H. R. H. Prince Bernhard, the Ambassadors of the United States, Great Britain, France and seven other N.A.T.O. countries, as well as the Dutch Prime Minister and many other members of the Netherlands Government, was the most interesting air show ever held in Holland. At the same time it was a convincing demonstration of the growing power of N.A.T.O.s air forces.

It was more than that. It was a demonstration of the striking advance in aviation engineering achieved in these 40 years of aviation history. The demonstration of Fokker's earliest aircraft, "de Spin" ("The Spider"), in comparison with the spectacular appearance of the giant Convair B-36 bomber was convincing enough.

Apart from the bigger aircraft, which included a new *Super Constellation* of K.L.M., Hawker Chief Test pilot Neville Duke and his Hawker *Hunter* aroused much interest, since the *Hunter* is to be produced in Holland and Belgium very soon as a welcome replacement for the older *Meteor Mk.8.* So did the Marcel Dassault MD 452 *Mystère* flown by the famous Colonel Rozanoff.

It was a pity indeed that Fokker was unable to demonstrate its own S.14 *Mach Trainer*—the aircraft is being re-equipped with a Rolls-Royce *Nene*. However, this did not prevent Gerben Sonderman from showing off his piloting genius aboard a Fokker S.11 primary trainer. France's Morane-Saulnier MS 755 *Fleuret* jet trainer was another of the star attractions.

The final fly-past of 300 N.A.T.O. jet aircraft, including *Sabres, Thunderjets, Meteors* and *Vampires,* concluded the air display. As far as the Royal Netherlands Air Force is concerned, one is tempted to apply to it the familiar expression—"Life begins at forty."

Distinguished spectators : H. M. Queen Juliana between Netherlands Prime Minister Drees *(right)* and General Aler, Commander of the Royal Netherlands Air Force *(waving a paper)* ; left of him, Prince Bernhard.

General Aler, Chief of the R.N.A.F.

Santos Dumont "Demoiselle" monoplane at Soesterberg.

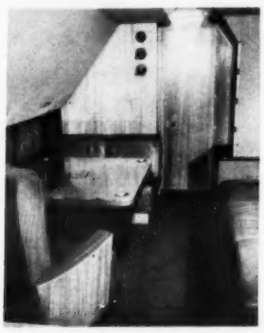
Dutch and Belgian parachutists descending behind a screen of N.A.T.O. flags at Soesterberg.

"Flying Palaces"

"Flying Palaces ?" An exaggeration, perhaps, but did one not speak of "floating palaces" or "palaces on rails" when heads of state went on trips aboard their resplendent yachts and special trains in the good old surface-bound days ?

Left : The special Lockheed *Constellation*, christened "Columbine," used by President Eisenhower and his Ministers. *Right :* Major William G. Draper, U.S.A.F., Air Force Aide and pilot to the U.S. President, who has flown "Ike" over 180,000 miles and 14 countries since his appointment as N.A.T.O. chief in Paris. (Courtesy, "The Indianapolis Times.")

Ex-President Truman used to travel by the U.S.A.F.'s special-mission Douglas DC-6, "The Independence."

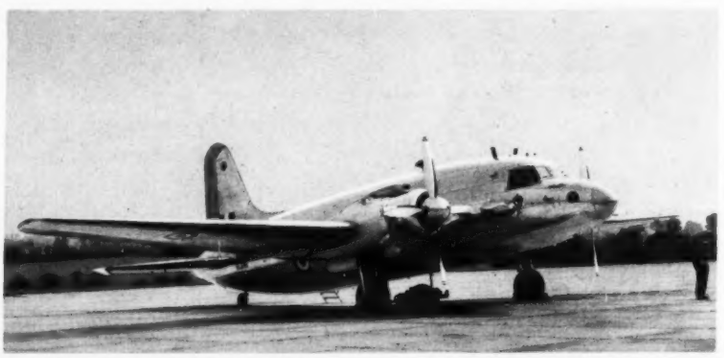


Looking forward in the executive stateroom of "The Independence." Bed-divan on right. Carpeting and leather wainscotting are chocolate brown, all wood is bleached mahogany.

Not all heads of state live in palatial luxury today, but most of them have taken to the air for travelling over any distance. And for most of them special aircraft have been set aside, equipped to afford maximum comfort to their illustrious—but occasional—occupants. Nearly all of these aircraft are converted commercial models, but at least one is a former attack bomber.

The largest of these transports is, fittingly enough, at the disposal of the President of the free world's greatest nation, the U.S.A. The aircraft is a Lockheed *Constellation,* christened "Columbine." Ready for use by President Eisenhower or members of his Cabinet

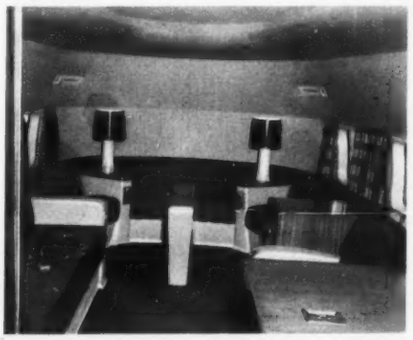
Queen Elizabeth leaving a Vickers *Viking* of the Queen's Flight. (British Crown Copyright.)



One of the five *Vikings* making up the Queen's Flight. The propellers have a brilliant metal finish, and whenever a Royal aircraft lands a mechanic rushes up and polishes the blades for all he's worth. (British Crown Copyright.)

During their Canadian trip in 1951, Princess Elizabeth and the Duke of Edinburgh travelled extensively in this special Canadair luxury transport of the R.C.A.F.

The rear lounge of the aircraft is reserved for the most important persons aboard the R.C.A.F.'s V.V.I.P. aircraft. It seats 13 persons. There are another 24 seats in the main cabin.



The "cook" aboard the R.C.A.F.'s luxury transport was Flight Sergeant Didow, who used infra-red ovens to prepare the meals. The telephone connects with the cockpit, the lounge and the galley.

twenty-four hours a day, it is the responsibility of an Air Force officer, 32-year old Major William G. Draper, who is in charge of a seven-man crew and has an office in the White House. The major must see to it that the aircraft is in operating shape at all times.

In one respect the "Columbine" is an exception among the normal run of "V.V.I.P." aircraft. Possibly because President Eisenhower has not entirely got out of his military habits, the aircraft has an Army khaki interior. Apart from that it is comfortable enough and provides a separate office and continuous two-way air-ground communication for the Chief Executive. Photographs of the aircraft interior are not available, owing to "security" restrictions.

President Eisenhower's "Connie" is the third large transport at the disposal of a U.S. President. Franklin D. Roosevelt travelled across continents and oceans in a plush version of the Douglas C-54 *Skymaster,* well remembered as the "Sacred Cow." Harry S. Truman had both the Connie and a special version of the Douglas DC-6. Truman preferred the luxurious interior of the latter, which was called "Independence."

*

The *Queen of England* does not have a very large or a very modern aircraft, but she makes up for that in numbers. The Queen's Flight in fact consists of five Vickers *Viking C. Mk. 2* twin-engined transports—two for the transport of members of the royal family, two for the royal suite or household (these are also used for crew training) and a reserve aircraft. The Queen recently expressed the wish that the aircraft should be used in future also by Ministers and other V.I.P.'s. The Captain of the Queen's Flight is Air Commodore Sir Edward H. Fielden, who was the pilot of King George VI's first aircraft (an Airspeed Envoy) when the Flight was formed in 1936. Commanding Officer and chief Pilot is Wing

This special Sud-Ouest SO 30 *Bretagne* transport, named the "France," is the first V.I.P. aircraft at the personal disposal of a President of the French Republic.

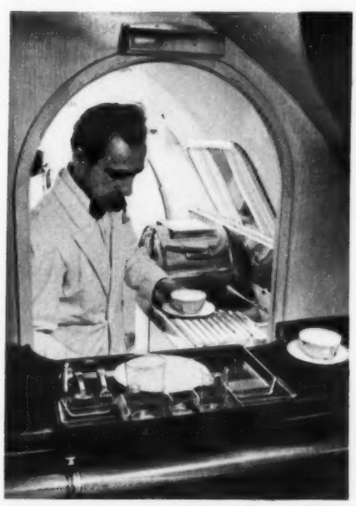
President Vincent Auriol joking with his personal crew. Smiling, from left to right: Warrant officer *(adjudant)* Martineau and Chief Warrant Officer *(adjudant-chef)* Delacour, flight engineer; Captain Canteraine, pilot; the President; Colonel Cressaty, Air Adjutant to the President; Captain Guénard, navigator.

The dining table in the presidential cabin of the "France." Note the recesses for the drinking glasses.

The secretary's desk in the central cabin of the "France," complete with switchboard (right, below the desk) and telephone.

Making up a bed in the presidential cabin of the "France."

The galley aboard the "France," seen from the bar.



The bar at the rear of the French President's aircraft.

The President of Mexico uses a converted Douglas B-26 "Invader" light bomber for his travels. It has three comfortable seats in the rear cabin.

Commander J. E. Grindon. The total personnel strength of the flight is about 80 officers and airmen, and during the twelve months to May 31st, 1953, the five aircraft flew 1,045 hours.

Passenger accommodation in the two Royal aircraft is divided into two saloons, each containing four seats with Irving "Chairchutes." No pictures of the interior are released—for "security" reasons.

During their tour of Canada in 1951, the (then) Princess Elizabeth and the Duke of Edinburgh made extensive use of a special Pratt & Whitney-engined Canadian *North Star* of the Royal Canadian Air Force.

A special feature is part of the presidential Sud-Ouest SO.30 *Bretagne* twin-engined airliner, the "France," which is at the disposal of *President Vincent Auriol:* it has a bar, with two stools. This obviously does not mean that M. Auriol is a dry martini addict, but it shows that even in the matter of official air travel the French don't forget to add a touch of *savoir vivre.*

The "France" is designed not only for use by the President himself, but also by distinguished official visitors and is furnished accordingly. The presidential lounge and the central lounge for visitors, complete with a writing desk, are a model of good taste.

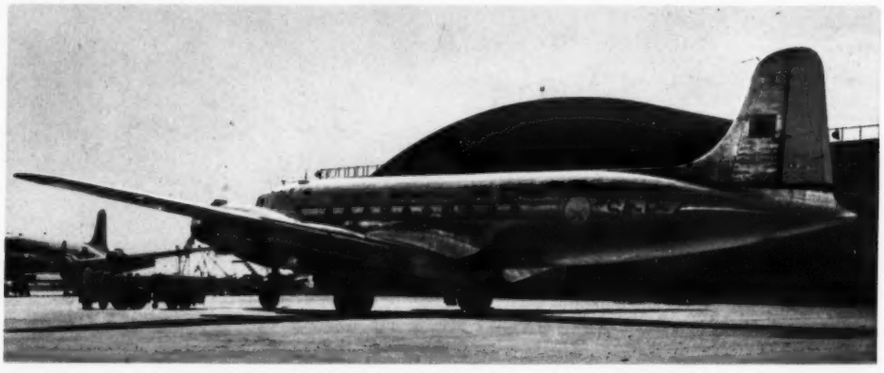
The aircraft is under the charge of Colonel Cressaty, Air Adjutant to the President. The crew consists of four men—pilot is Captain Canteraine—to which stewards and other personnel are added when necessary.

*

The *President of Mexico* uses a converted Douglas B-26 *Invader* twin-engined attack bomber called "El Indio" for his travels—the fact that the aircraft used to be a bomber probably is in no way connected with the proverbial turbulence of Latin American politics. This is strictly a "personal" aircraft, for it seats only three passengers in its plush rear cabin. The President at one time was reported to have ordered a *Convair Liner* twin-engined transport for executive use, but it is not known at this writing whether the aircraft has been delivered.

*

Air travel by V.I.P.'s in all parts of the world has proved to be contagious and has given rise to a new business—conversion of commercial and military types into super-luxury private airliners. One of the companies engaged in this kind of work, *Transocean Air Lines,* of Oakland, California, which also doubles as a large irregular air carrier and trading company, recently bought and converted a Douglas DC-4 for *King Ibn Saud of Saudi Arabia.* Ibn Saud has always been partial to modern improvements and, apart from a large number of wives and other luxuries, owns a fleet of high-powered automobiles. His aircraft, which is based at Jedda airfield, bears his coat of arms of two crossed scimitars. It incorporates such unusual features as a retractable elevator to lift his wheelchair (the king is badly crippled by arthritis) into the fuselage. Next to the king's bedroom, the aircraft has a revolving throne which can be turned to face the holy city of Mecca no matter in what direction the aircraft is flying. Adjoining the throne room is a

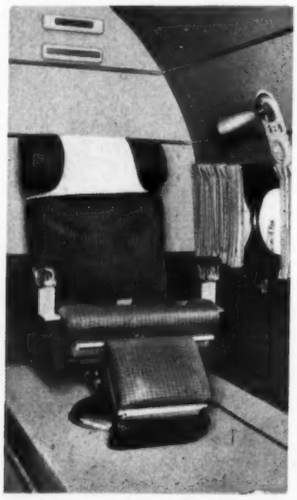


King Ibn Saud of Arabia's latest luxury, a Douglas DC-4, bought from and converted for his use by Transocean Air Lines, enables the monarch to view his desert domain from aloft. Note the King's personal coat of arms on the rear fuselage.

King Ibn Saud going up on the royal elevator for the first time at Riyadh, Saudi Arabia, just a year ago. Captain Sam L. Wilson, Executive Vice-President of Transocean, operates the elevator controls; J. Metzger, Operations Manager of Saudi Arabian Airlines, and the King's retinue watch.

His Majesty King Ibn Saud is helped into the aircraft from the special retractable elevator.

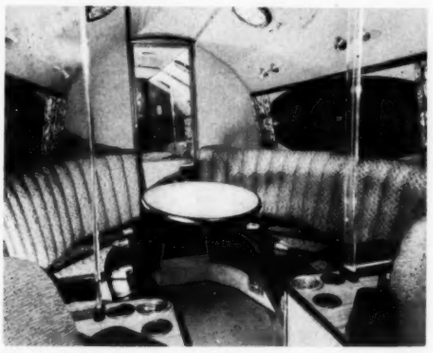
Ibn Saud's revolving "throne" faces the holy city of Mecca no matter in which direction the aircraft flies.



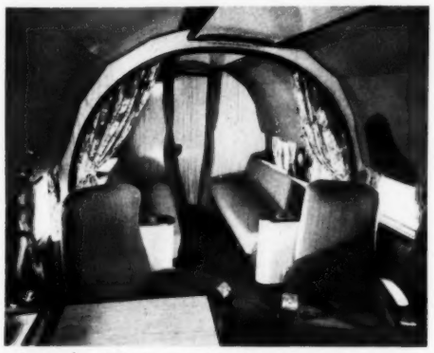
AiResearch Aviation Service Company of Los Angeles has turned a decrepit Martin B-26 *Marauder* war surplus bomber into a fast 16-passenger executive transport for the Tennessee Gas and Transmission Company. Note dorsal fin, tail cone, elliptical picture windows.

This is what the Martin B-26 looked like when it arrived at AiResearch's aircraft service plant.

Swivel chairs in centre section of fuselage. On cabinet between chairs is the air-to-ground telephone.



The horseshoe-shaped rear lounge of the converted B-26. Note picture windows.



AiResearch Aviation Service Co. shows what can be done to a *Douglas DC-3* twin-engined transport in the way of luxury conversion.

private room with four seats, and the remaining space is occupied by standard reclining seats for the king's retinue. The whole is upholstered in seven different shades of green.

*

Another company which has found aircraft conversion work profitable is the *AiResearch Aviation Service Company* of Los Angeles, a Division of the Garrett Corporation, well-known as manufacturers of a variety of aircraft equipment. A recent *tour-de-force* by AiResearch was the conversion of a war-time Martin B-26C "Marauder" twin-engined attack bomber—which had acquired an unjustified reputation as a "dangerous" aircraft during the war years—into a 16-passenger, high-speed executive transport for the Tennessee Gas and Transmission Company—*and getting it certificated for civil use by the U.S. Civil Aeronautics Administration.* The pictures show what the aircraft looked like when it got to California, as well as the effects of its "face-lifting," in the course of which more than 75 per cent of the airframe was replaced. The most noticeable exterior change is the long straight dorsal fin, the long, pointed tail cone, and the elliptical "picture windows" aft of the wing trailing edge. Altogether, the aircraft and its conversion cost considerably less than the purchase price of a new aircraft of similar speed and capacity, namely, about $400,000. So successful has the conversion proved to be that a second machine is now being similarly converted—for the same company. Other large firms are also interested, and AiResearch is now casting around for flyable survivors of this once much-maligned World War II type !

Considerations of travelling speed (340 m.p.h. cruising) rather than economy guided another industrial firm, the *Brown Paper Mill Co.,* of Monroe, Louisiana, when it decided to order an executive transport version of the Douglas B-26B *Invader* attack bomber from a third of the several companies specializing in this kind of work on the U.S. West Coast, the *Grand Central Aircraft Co.* of Glendale, Calif. Early last month the aircraft was ready for equipment with luxurious furnishings for six passengers. One of the most outstanding features of this "private aircraft" is the fact that—unlike the Mexican President's B-26—it has a pressure cabin maintaining a "cabin altitude" of 7,500 feet at a flying altitude of 17,500 feet.

Neither the owners nor executives of Grand Central Aircraft Co. are inclined to reveal the total cost of the plush six-seater executive transport. However, estimates offered by several competitors in the aircraft conversion field lead to the conclusion that the price may exceed $1,250,000—which is roughly the cost of a brand-new four-engined Douglas DC-6B transport capable of carrying 58 passengers in first-class luxury !

Glendale, Calif.: the Douglas B-26 *Invader* bomber converted for Brown Paper Mill Co. by Grand Central Aircraft Co. Cost is estimated to exceed $1,250,000 !

Preview of the Turin Technical Exhibition

Turin, August 1953 : The place of honour at the Third International Technics Exhibition, which will be held in the spacious halls of Turin's *Palazzo di Esposizioni* from September 30th to October 11th, 1953, is reserved for the Italian and foreign aircraft industries, which this year are taking part for the first time in this annual event. Other exhibitors come from the metallurgical, mechanical engineering and machine-tool industries, electrical engineering, the plastics industry, the optical industry and the building machinery branch. A preview, prepared almost two months before the opening of the show, naturally cannot hope to do more than give a very *general idea* which will doubtless need retouching later.

In the aviation field, the Show's organizing committee plans to introduce to the trade world a number of internationally less-known Italian products from the equipment and accessories industry, supplementing these with semi-finished articles and auxiliary materials. The committee is under the chairmanship of *Count Gian-Carlo Camerana,* Vice-President of Fiat, who is assisted by Engineer Natale Penazzo and Dr. Gino Pestelli, Fiat's publicity manager.

Entrants from abroad include the *General Electric Co.* (New York), the French *Syndicat des équipements et du matériel aéronautique*, *Société des Avions et Moteurs Henry Potez* and a number of *British firms,* including Smith Aircraft Instruments.

Italian exhibitors will be headed by the *aviation section of the Italian Defence Ministry,* which will be showing a series of training equipment and weapons, while the *Associazione Imprese Aeronautiche* will exhibit on behalf of Italian aircraft manufacturers.

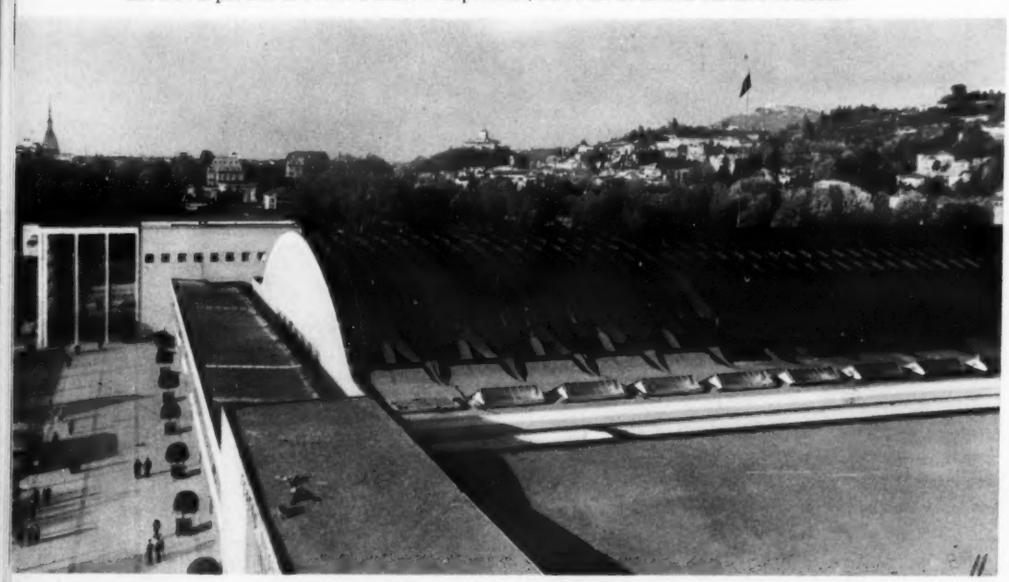
Fiat, one of Italy's leading firms, will show the masterpiece of its *Lingotto* Engine Division, the *Allison J-35* axial compressor jet engine built under licence to the order of the U.S. Air Forces in Europe. This engine is to be fitted in the Republic F-84 *Thunderjets* supplied to N.A.T.O. countries. The *Aeritalia* Aircraft Division is represented by models of the Fiat G.80 jet fighter and of a number of older Fiat aircraft. Fiat is also showing its well-known cars, as well as metallurgical products, machine tools, etc. *Piaggio & Co.,* of Genoa, are expected to show their Lycoming O-435-A aircraft engine, which is being built under licence at the Finale Ligure plant, and the Piaggio 1030 and 1033 two- and three-bladed v.p. propellers. Designed for engines of up to 300 h.p., these propellers have elastic blade mountings which reduce alternating stresses, cut vibration frequencies by 50%, and prevent the transfer of vibrations to the airframe.

Costruzioni Aeronautiche Giovanni Agusta will illustrate their production of the Bell 47 helicopter at the Gallarate works with a series of factory photographs and provide a model of their AZ.1 twin-engined propeller turbine commercial transport, which has been developed to a design of Engineer F. Zappata. *Count Manzolini di Campoleone* plans to demonstrate his *Libellula* helicopter, which features a new type of cyclic pitch control (with jointed mounting of the rotor blades), based on patents by Engineer Bordoni.

Count Giovanni Bonmartini and the *Etablissements Sciences Techniques* which he heads will show models of a new caterpillar undercarriage with tandem wheels and independent telescopic suspension; *Aerostatica* will have seat and back type parachutes of the Salvator 50 model on show. *Microtecnica* will be offering remote-reading gyroscopes, artificial horizons, and transformers built under Bendix licence. *Filotecnica Salmoiraghi,* which supplies American gyroscopes for N.A.T.O.'s F-84 and F-86 jet fighters on behalf of the U.S. Air Force, will also be showing the CL-1/A gyroscope and HL-5 electrical artificial horizon built under licence from the British firm of Sperry Gyroscope Co., in addition to air speed indicators and turn-and-bank indicators, oxygen equipment and meteorological equipment.

Ottico Meccanica Italiana will enter six instruments for stereometric evaluation of aerial photographs, developed by Engineer Umberto Nistri, as well as a number of instruments built under Bendix and Smith licences, while *Fabbrica Italiana Magneti Marelli* will show its magnetos, sparking plugs and electric starters for piston and jet engines, electrical aircraft instruments, equipment for R/T links and radio transmitters. *Oleodinamica Magnaghi* is expected to be represented by a selection of hydraulic aircraft equipment, wheels and wheel brakes, shock absorbers, propeller regulators, pressurization equipment, fuel and lubricant tanks and machine tools. *Officine di Villar Perosa* will have ball and roller bearings, turbine and compressor blades, cylinder bushes, Silentbloc vibration absorbers and a number of products made of plastics. Another exhibitor in this field will be *Vetrocoke* with plexiglas

The central pavillon of Turin's Palazzo di Esposizioni, where the air section will have its stands.



Partial view of the central pavillon of the Palazzo di Exposizioni,

products and with sound-proofing fibre-glass. *Secondo Mona* has a model collection of carburettors, pumps, regulators, and refrigeration equipment to offer, while *Zenith* is restricting itself to carburettors and engine accessories.

It is not yet certain whether *Pirelli* will take part in the Aviation Show, as this well-known manufacturer of tyres and rubber boats is reported to have only slight interest in aviation these days. On the other hand, *Francesco Rabotti* will be demonstrating sundry checking equipment for pumps, electrical aircraft instruments and pressure gauges. *Officine Viberti* will probably show various fuelling trucks and special vehicles for airports, as will also the firm of *Emanuel,* which specializes in mobile repair shops, crane trucks for salvaging aircraft and engine compressors.

Ci-o-due, a firm which produces Walter Kidde and Co. Inc. (Belleville, N.Y.) products under licence, will present a model collection of foam and spray-type fire-extinguishers (some of them mounted on special vehicles) and fire-warning equipment which responds to smoke or temperature, as well as compressed-gas

Count Gian-Carlo Camerana, Chairman of the Third Turin International Technical Exhibition.

flasks for inflating life-belts and rubber dinghies, petrol filters, etc. Finally, the fuel firm of *Rifaer,* which supplies Italian airports with high-octana aviation spirit and kerosene, is also to participate. *Alluminio,* a sales organization belonging to the *Montecatini* group, will have high strength aluminium forged alloys and other metallurgical products on show.

It is not yet known what the electrical engineering firms of *Edison* and *Siemens* and the *Breda-Beretta-Hispano* arms concern will show. Other possible exhibitors are *Compagnia Mediterranea* (instruments), *Teleflex Italiana* (remote controls), *Fausto Carello* (lamps and filters), *Itala* (pressure-tight pipes and cables), *G. Pozzolo* (night flying equipment and electronic gauges), *Apparecchi O.S.* (fuel gauges), *Buini & Grandi* (airport lighting).

An exhibit by the *Aero Club of Italy* and probably by the new *Turin Castelle* commercial airport, with documents from *Alitalia* and *Linee Aeree Italiane* will supplement the varied collection of industrial products.

GIORGIO LOURIER

Fact Sheet on the Italian Aircraft Industry

Labour force : 10,000 persons, namely :

Manufacture, repair and overhaul of airframes	5,000
Manufacture, repair and overhaul of aero engines	1,800
Manufacture, repair and overhaul of accessories and equipment	3,200

The Italian aircraft industry proper consists of 19 companies, of which 16 make only airframes, two airframes and engines, and one egines only. They are :

Name	*Capital-lire (000)*	*Product*
Aero Caproni Trento	15,000	Aircraft
Aeronautica Macchi	120,000	Aircraft
Alaparma	...	Aircraft
Alfa Romeo	500,000 (to be raised to 2,500,000)	Engines
Costruzioni Aeronavali (S.A.C.A.)	24,000	Aircraft
Costruzioni Aeronautiche Giovanni Agusta	...	Aircraft
Costruzioni Aeronautiche Nardi	1,000	Aircraft
Costruzioni Meccaniche Società Romana	50,000	Aircraft
Fiat	57,000,000	Aircraft and Aero-Engines
Industrie Meccaniche Aeronavali Meridionali	200,000	Aircraft
Lagnami Pasotti	5,000	Aircraft
Meteor	10,000	Aircraft
Piaggio	630,000	Aircraft and Aero-Engines
Partenavia	...	Aircraft
Pomigliano d'Arco (Aerfer)	1,000,000	Aircraft
Officina Meccanica Aeronautica	...	Aircraft
Officine Aeronavali	10,000	Aircraft
Società Aeronautica Italiana, Ing. Angelo Ambrosini & Co.	50,000	Aircraft
Società Italiana Aeroplani Idrovolanti Marchetti	405,000	Aircraft

In 1946, the first post-war year, Italy's aircraft industry exported aircraft, engines and equipment valued at 1,000,000 lire, a figure which rose to beyond 5,000,000,000 in 1952. In 1953, the Italian industry was awarded substantial U.S. off-shore contracts, which in coming years will increase its "exports" beyond the level reached in 1952.

T.A.P. Becomes a Private Airline

Whereas in many countries the present tendency is towards nationalization of transport—in particular of air transport—Portugal is following the opposite course. *Transportes Aereos Portugueses,* which had been set up in mid-1944 under the Directorate General for Civil Aviation and since the autumn of 1946 had been working as a Government "development company" to build up a Portuguese route network, has been turned into a private company *(Sociedade anonima de responsabilidade limitada)*, in which, however, the Portuguese Government and the Governments of Portugal's overseas possessions hold the majority of the capital.

Two years ago the Portuguese Government put T.A.P. up for sale to the highest bidder, but the offers received at that time from France and the United States (including one from a travel agency controlled by P.A.A.) do not appear to have met with its approval.

However, it has now been converted into a private company, retaining the internationally-known name of T.A.P. The fully-paid-up initial capital consists of 120,000 shares (of 1,000 escudos par each), 100,000 of which have been subscribed in cash and the remaining 20,000, held by the Directorate General of Civil Aviation, have been paid for in kind (in the form of the equipment from the old T.A.P.).

The stock is held by the Portuguese Government, the Governments of the African Colonies of Angola, Mozambique and Sao Tomé, several banks, shipping and oil companies and, finally, a number of private subscribers.

Under the terms of its operating licence, T.A.P. is required to fly certain given routes of public interest (passengers, mail and freight), namely Lisbon to Oporto, Funchal, Tangier—Casablanca, Sao Tomé—Luanda—Lourenço Marques, Madrid, Paris, London, Rio de Janeiro.

As these lines go to print, a decision on the new fleet for T.A.P. is probably being taken. The first large order is expected to be for either three *Super Constellations* or three Douglas DC-6Bs. It has been said that the company has some $4,000,000 to $5,000,000 to spend on this first order.

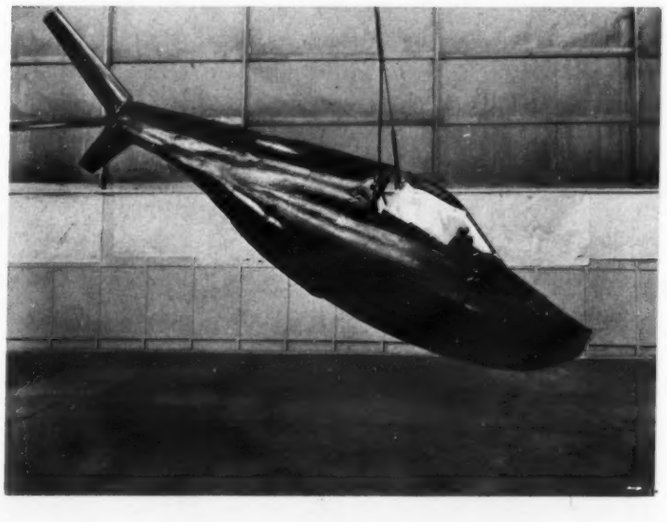
The *new T.A.P.'s Board* comprises *(left to right) : Board Chairman,* delegated by Portuguese Government : *Francisco de Melo e Castro* (administrator of State Railways); *Members of the Board :* Carlos E. Bleck (head of the former C.T.A., T.A.P.'s predecessor); Dr. José Nunes de Oliveira (Inspector General of the Colonial Administration); Dr. Carlos Moura Carvalho (Vice-Governor of the Bank of Angola); Captain Albano Rodrigues de Oliveira (Chairman of the Corporations Chamber); *Managing Director :* Brigadier General Carlos M. Magalhaes (General Manager of the old T.A.P.).

Baling out at 50,000 feet

How is the pilot of a fighter or bomber flying at supersonic speed and an altitude of 50,000 ft. to get out of his aircraft in an emergency? This is the question the crews of modern aircraft asked the aircraft designers one day. It had long been recognized that it would not be possible to bale out by parachute in the traditional manner.

Working on the problem like several other firms, Douglas Aircraft Co. has come up with a radical solution: the whole "inhabited" part of the aircraft is separated from the rest of the airframe and floats to earth suspended from one or more parachutes. The pilot, who wears a personal parachute "just in case," does not leave his seat until after he has landed.

Our picture shows a model of the "Cockpit Escape Capsule" developed by Douglas for the U.S. Navy. It is provided with an explosive charge to release it from the rest of the aircraft in case of necessity. During the first phase of "free flight," the capsule is stabilized by three folding fins and slowed down to its normal speed of descent by a small high-speed parachute. Then the parachute proper opens, and the capsule, with the pilot inside, sinks to the ground. The capsule is pressurized and buoyant in case it alights on water. Emergency rations are also provided, to enable the pilot to hold out until rescue comes.



Aviation Trends in "Quadrizonia..."

"Quadrizonia" might designate certain Central European countries which, in the absence of peace treaties, are controlled by the four World War II Allies, in more or less harmonious cooperation : in other words, Germany and Austria. Both are flirting somewhat shamefacedly with the possibility of rebuilding their civil aviation.

*

A great deal has been written recently both inside and outside Germany about developments in *Western Germany,* much of it—even, we will admit, in *Interavia*—not altogether reliable. One of the reasons for this may be that pronouncements on German civil aviation emanate from two different sources : on the one hand from the press section of "Luftag" *(Aktiengesellschaft für Luftverkehrsbedarf),* in other words, the forerunner of a future new Deutsche Lufthansa ; on the other hand, from the entourage of Federal Transport Minister Dr. Hans-Christoph Seebohm, who claims a majority holding and hence the deciding voice in the new *Lufthansa* for his Ministry. Here and there, too, there are interjections by the nucleus of a new German aircraft industry in its early struggle for life—though these latter are still only platonic announcements.

Transport Minister Seebohm, who is responsible for German civil aviation, is an active party politician and a somewhat headstrong man whose motto appears to be : "We Germans fear God, but nothing else." A leading member of the *Deutsche Partei,* he has his little private feuds. At the end of July, 1953, these engaged—according to the widely circulated German weekly "Der Spiegel"—the attention of the Federal Cabinet and of Chancellor Dr. Adenauer himself. According to "Der Spiegel," with whom responsibility for the statement must rest, Chancellor Adenauer brushed aside Seebohm's documents at the Cabinet meeting of July 31st with the laconic remark : "A lot of nonsense . . ."

In the view of some of Herr Seebohm's opponents—and they are numerous—his plans for some of Germany's transport branches and particularly for the tender shoots of her future air transport may well be on the same plane . . . But there is no point in anticipating events, for new elections in the West German Federal Republic are planned for September 5th. Herr Seebohm may continue to administer transport after that, or it may be that a successor will have to be found. It is also likely that the air administration, the Board of *Luftag* and *Luftag* itself will be seriously developed and given additional staff, so that aircraft with German markings can open their first European services in the spring of 1954 (Convair 340s) and their first overseas services in 1955 (Lockheed *Super Constellations*).

So much for the present. In a bare four weeks the curtain may be raised a little higher over German air transport plans.

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Further south-east, in the small *Austrian Republic,* the first striking fact is that practically nothing is being said outside the country about the prospects for Austrian aviation.

Early in 1953 *Interavia* received a communication from a competent Austrian, who wrote in slightly embittered tones on the situation as it was then : " . . . Whereas in the rest of the world more and more up-to-date aircraft cross the skies, as a symbol of technical and economic progress, Austria must restrict herself in practice to gliders and aircraft models . . . Austria for example, still is not permitted to exercise any control over international air transport over her territory. She is not even allowed to be responsible for her own airports, for maintaining them or adapting them to modern requirements. And of course, she may not even begin to think about running any kind of air services of her own. The Austrian aerodromes are still requisitioned by the various Occupation forces. There is still no Austrian air travel agency, and not even an Austrian air freight centre . . . Foreign airlines wishing to fly over Austria still have to get permission from the Allies before flying over their four Zones . . . It is now eight years since the end of the war, and Austria asks for the restitution of her air sovereignty. She also asks that the air traffic control service be transferred to Austrian hands and the aviation meteorological service to Austrian administration. The Austrian airports should be given back to the Austrian air administration. Finally the country asks that it may form a new airline, to replace the *Österreichische Luftverkehrs AG (Oelag),* which enjoyed an international reputation up to 1938."

Such was the position in the spring of 1953. How far it has changed since then can be judged from the following *exposé,* written by a well-known international expert with first-hand knowledge of the situation :

" . . . It is unthinkable that Austria should remain a blank on the aviation map. First signs of a rebirth in Austrian aviation are already visible. Gliding has been resumed in the Tyrol and above all in Salzburg, with the Occupation authorities benevolently closing their eyes. A few powered aircraft have even appeared, generally being used as glider tugs. An air rally in Graz, in the spring of 1953, which brought foreign guests into the country, recalled the popular Austrian Whitsun air meetings of pre-war days.

"There are now several signs that the development of Austrian aviation and even of an Austrian airline will be able to proceed more rapidly than would have seemed possible a year ago. For example, K.L.M. Royal Dutch Airlines and Swissair suddenly got Russian permission, one fine morning in July, to fly to Vienna without restriction. At about the same time, management of Vienna-Schwechat airport, in the British sector, was returned to Austrian hands . . . True, political and financial difficulties appear to postpone the resumption of Austrian national air transport to a somewhat distant future, unless . . . Unless one of the bigger air powers actively sponsors the formation of an Austrian airline.

"The country might even raise modest funds to get it started, if Britain and France follow the example of the United States and Russia in foregoing occupation costs. Professor Kamitz, Austria's energetic Finance Minister, would then be able to provide funds for the expansion of the three Vienna airports. Then Austria could emulate Germany and take over air traffic control services, and then the rebirth of *Oelag* would enter the realm of the possible.

"What is envisaged here is not a process such as is taking place in Germany today, where a large and completely autonomous national airline is being aimed at from the start. But a beginning could be made in conjunction with an existing organization in a country friendly to Austria. The purchase of modern aircraft from Austrian funds would be by no means excluded under such an arrangement.

"Let us take up the cudgels for the small nations. Why should not Austria, too, be given back her flying and thus a feeling of self-confidence and of post-war difficulties overcome !"

He floats through the air with the greatest of ease...

Images from the history of the parachute

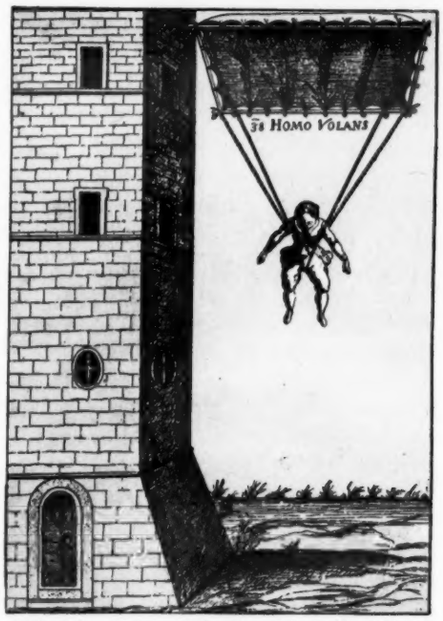
Parachutes for troops, arms, supplies, tanks, life-boats . . . parachutes for braking the landings of high-speed aircraft . . . cargo parachutes 200 ft. in diameter for dropping sections of great steel bridges . . . The parachute has unquestionably become a technical and strategic factor of first importance. It has done so at a speed which puts even the record development of the aircraft into the shade. Powered flight celebrates its golden jubilee this year, but the first practical parachutes for use from aircraft are not even 35 years old.

This is all the more striking in that man is known to have thought of "hovering" much earlier than of "flying." Archaeological discoveries in Africa show that the forefathers of today's bushmen tried in their "bird dances" of prehistoric times to hover in the air for brief moments using umbrella-like devices.

*

One of the earliest reports of a real jump comes from Simon de la Loubère, a special envoy from the French king to the court of Siam. In his account of this journey, published in 1691, he relates that the *pièce de résistance* of the King of Siam's favourite tight rope dancer was to jump from the top of a high bamboo structure, when the wind was right — to float down to earth with the aid of two enormous parasols.

Strangely enough, these coloured Oriental silk umbrellas were more closely connected with the design of the first practical parachute of European design than the far more serious drawings of Leonardo da Vinci. It was not da Vinci's "Codice Atlantico" but Loubère's book that fell into the hands of Louis-Sébastien Lenormand, the watch-maker of Montpellier who wrote down the first practical design details for a parachute and jumped from second-story height on December 26th, 1783. This jump passed off quite well, but what happened later was less pleasant. Abbé Pierre-Nicolas Bertholon, physics professor whom Lenormand had asked to help in the test jumps and to whom he entrusted his drawings, simply appropriated the plans and represented himself to the Montpellier Scientific Society as the author of the invention,

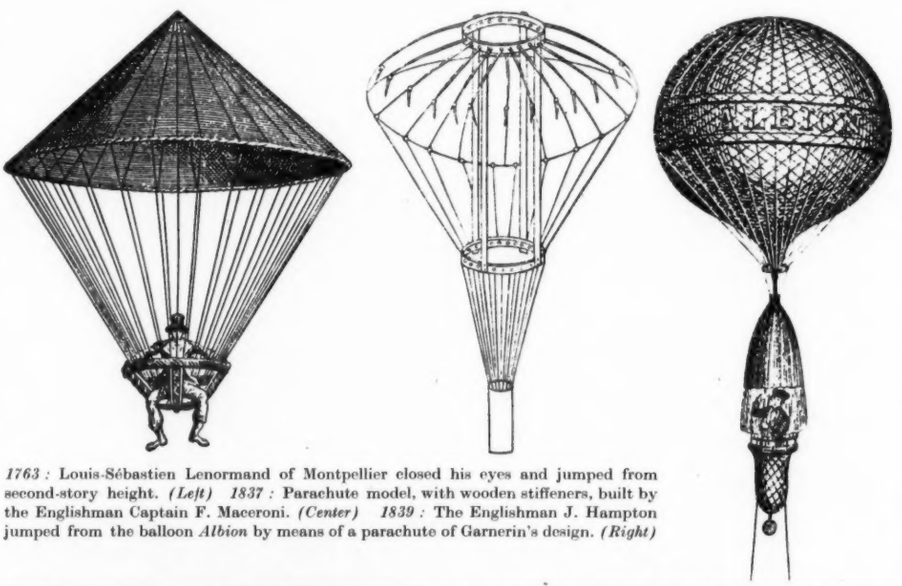


1616 : A hundred years after Leonardo da Vinci, Bishop Fausto Veranzio, in "Machinae novae," recommended this contraption, with the aid of which "a man can drop without danger from a tower or other lofty place..." Fortunately for Fausto's good name no one tried it.

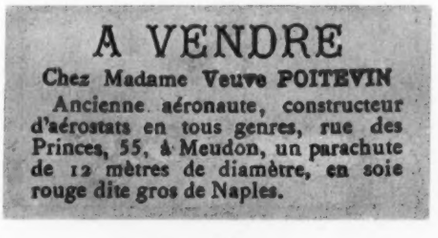
even using the name of "parachute" coined for it by Lenormand. The behaviour of Joseph Montgolfier, who also saw the experiments in Montpellier, was not much better. True, he did not claim the invention as his own, but he did conceal the name of the inventor and allow the parachute to pass, as common property, to the first generation of balloonists.

*

How the parachute, in the hands of these balloonists, gradually turned from a toy, a circus or fair-ground stunt, into a serious piece of aviation equipment, how the Frenchman André-Jacques Garnerin gave it the air vents essential to safe operation and how it was slowly developed through the nineteenth century into the reliable instrument of today, is so well known that repetition would be tedious. It suffices to recall the article "Parachuting Pioneers" by the late Squadron Leader H. R. Bunn in *Interavia* (No. 8-9, 1950), which



1763 : Louis-Sébastien Lenormand of Montpellier closed his eyes and jumped from second-story height. *(Left)* *1837 :* Parachute model, with wooden stiffeners, built by the Englishman Captain F. Maceroni. *(Center)* *1839 :* The Englishman J. Hampton jumped from the balloon *Albion* by means of a parachute of Garnerin's design. *(Right)*

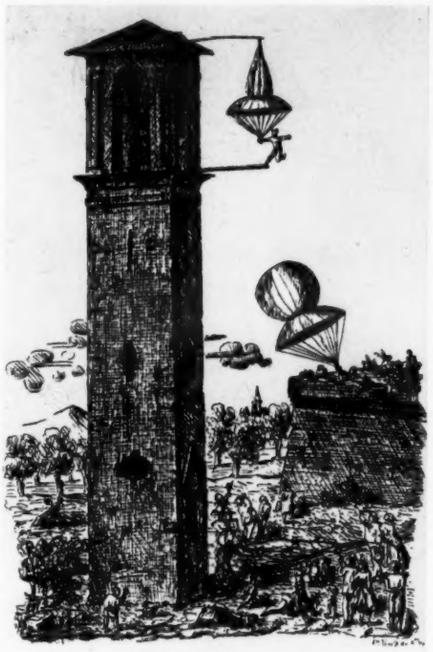

A VENDRE

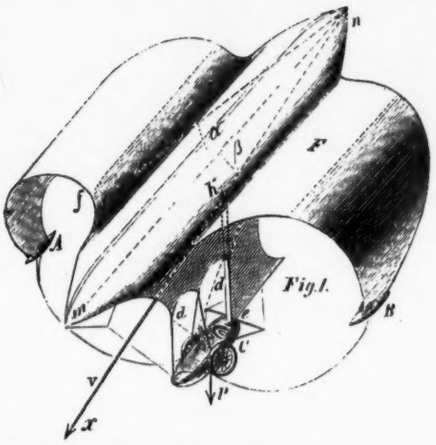
Chez Madame Veuve POITEVIN

Ancienne aéronaute, constructeur d'aérostats en tous genres, rue des Princes, 55, à Meudon, un parachute de 12 mètres de diamètre, en soie rouge dite gros de Naples.

cites all the names connected with the history of the parachute and describes their successes, set-backs and disasters : Blanchard, Kuparento, Cocking, Wise, Hampton and the rest.

1852 : After 38 successful jumps which the whole of Paris turned out to see, Madame Poitevin appears to have tired of the sport . . .

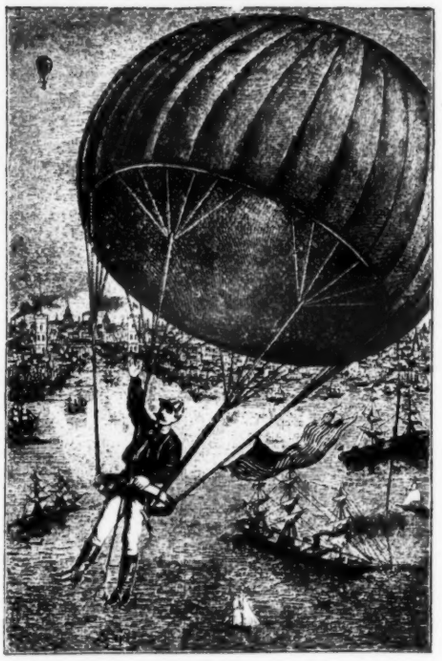




1876 : Lippert's "parachute-balloon," project for a combined parachute and dirigible balloon, to be powered by a gas engine designed by the Austrian Hänheim.

◀ *1870 :* The parachute designed by the Italian Allessandro Volante was composed of two parts, an upper sphere, which filled with air, and the actual umbrella.

1888 : The "drop balloon" made by the American Thomas Sacket Baldwin. ▶



1953 : A student at the Royal Canadian Air Force's air rescue school making a routine parachute drop.

Strictly speaking, however, the parachute as we know it today did not appear until the end of World War I. True, the American Captain Berry made the first parachute descent from an aircraft in flight at St. Louis, Missouri, back in 1912, and this feat gave a tremendous fillip to parachute discussion during the two years that followed. But many problems remained to be solved, particularly that of getting clear of the propeller slip-stream. Parachutes, too, were used in astounding numbers on both sides towards the end of World War I by fighter pilots and, above all, by the unfortunate captive balloon observers who, ruthlessly exposed to enemy fire, set up real records in parachute jumping. Some of them are said to have made as many as seven or eight descents a day.

Nevertheless it was not until the last year of the war that the systematic experiments leading to present developments were begun. The Americans tested the newly-developed seat-type parachute in 1,500 successful jumps from aircraft at McCook Field, near Dayton, Ohio. Introduced by the U.S. Army in 1919, this first standard equipment became compulsory for all Army fliers in 1922.

Thus was prepared the way for the parachute of the twentieth century, which performs equally astounding feats as an instrument of war and of peace (rescuing of the shipwrecked, dropping food supplies to isolated regions, etc.) and whose uses would seem to be far from having been exhausted.

F. K. M., BASLE

Interim Report on an Experiment

BY GÉRARD PILÉ, PARIS

North Atlantic Tourist Services in 1952

Atlantic travellers in peak season: American tourists « storm » the airport...

Will the tourist class fulfil its early promise? This is a question which is doubtless greatly exercising air transport planners throughout the world. Gérard Pilé, who examines below the economics of North Atlantic tourist class operations in 1952, can be regarded, so to speak, as the prince of statisticians on French air transport. An engineer of the Ecole Polytechnique *and* Diplômé de l'Institut National de la Statistique, *he is in charge of all official statistics on French commercial aviation. It was he, for example, who supervised the production of the reviews of French air transport—published by Secretary General of Civil and Commercial Aviation René Lemaire—which won universal acclaim for their objective reporting.* THE EDITORS

Increase in traffic volume and tourist class services

For obvious reasons the trade press is giving increasing attention to the results of the tourist class air services across the North Atlantic, introduced in May 1952. A provisional, though somewhat rudimentary, analysis of Atlantic traffic volume in 1952 certainly shows most encouraging results :

Compared with figures for 1951, Atlantic passenger volume increased by 31% in 1952, and even by as much as 38% during the period May to December. Whereas in 1950/1951 air services accounted for 45% of total trans-Atlantic traffic (shipping and airlines), in 1952 this percentage had risen to 52%, despite a marked increase in shipping traffic. These figures undeniably betoken considerable progress, which justifies very real hopes for the near future.

What was the effect of the introduction of tourist class services on these developments? This is the first question that comes to mind, and an attempt is made below to answer it, insofar as the figures available enable the subject to be assessed.

It would of course be wrong to credit the whole of the increase in Atlantic passenger volume to the tourist services. The continuing boom in Atlantic traffic as a whole, including shipping (the number of shipping passages sold in 1952 rose by 15%, although space offered by only 10%) would disprove such a view. On the other hand, it can scarcely be assumed that the airlines would have been able to raise their share in the total traffic very considerably without the "tourist class experiment." Thanks to more intensive utilization of their air fleets, which remained substantially the same in numbers, the Atlantic airlines were able to increase the number of services flown by 15% during 1952. However, they only ventured on this increase in frequency because the initial results of the tourist class services were so encouraging. *Without the tourist class traffic* the 1952 *increase in frequency* would presumably have been limited to 12%. And as there had been little change in the size of the fleet, the number of seats offered would have followed similar lines.

Finally, load factor would not have increased markedly. During the first four months of 1952—i.e. before introduction of the tourist class—it remained at the same level as during the corresponding period of the previous year, and during peak periods, load factors are in any case so high that they cannot be appreciably increased. In other words, without tourist services the 1952 traffic volume—judging by the general situation—would presumably have risen by 13% (a figure corresponding to the increase actually obtained in first-class ships passages).

Shift from first to second class

This being so, it may be conservatively assumed that tourist class services brought Atlantic traffic roughly 60,000 new passengers. Two out of every three Atlantic passengers would have gone by air in any case, with or without tourist class. On the other hand, first-class services are believed to have lost some 130,000 passengers to tourist class. As a total of 155,000 passengers travelled first class during the period May to December 1952, this means that first-class traffic was reduced by 45% by the introduction of the tourist class.

However, these figures must be treated with a certain reserve, as the drastic reduction in the number of seats offered on first-class services would in any case have entailed a reduction in passenger numbers. During the high season (second half of June in the West-East direction, round the 15th August and in September in the East-West direction) load factor on first-class services approached 100%. This suggests that the demand for first-class passages could not be fully met during the high season.

Added to this were the results of the strike in the American oil industry in May 1952, which led to very appreciable restrictions in fuel supplies and forced temporary cancellations of a number of first-class services (particularly by British and American companies). Therefore, these exceptional conditions make any assessment of the initial stage of tourist services extremely hypothetical.

In the light of these circumstances and of a closer examination of the results reported by the individual companies, the *reduction in first-class traffic due to the tourist class services was not 45% but only about 40%*. This percentage is, of course, only a mean value and varies considerably from one company to another. Pan

American World Airways, for example (who were the first to advocate the tourist class), has a hard core of particularly wealthy American clients and therefore suffered a relatively small decrease in first class demand : not more than 30% at the outside. Nevertheless, P.A.A. recorded the highest number of tourist passengers, despite the fact that the proportion of their services given over to tourist class was the lowest of all trans-Atlantic airlines. On the other hand, the falling-off in first class passenger volume in certain airlines, such as S.A.S., was over 50%.

Transfer from ship to aircraft

Without a doubt it was the reduced rates charged on tourist services which attracted a new category of travellers on Atlantic services. It can be supposed that tourist rates induced large numbers of Americans to fly to Europe on short vacations.

However, it would be misleading to consider only the question of cost in this matter. Calculations of this kind would be valid only if the travelling public had an unrestricted free choice between two classes of travel. But during the peak season this is by no means the case.

The peak period for shipping and air services is as follows :

West-East direction :
shipping : May to July (three months),
aircraft : June and July.

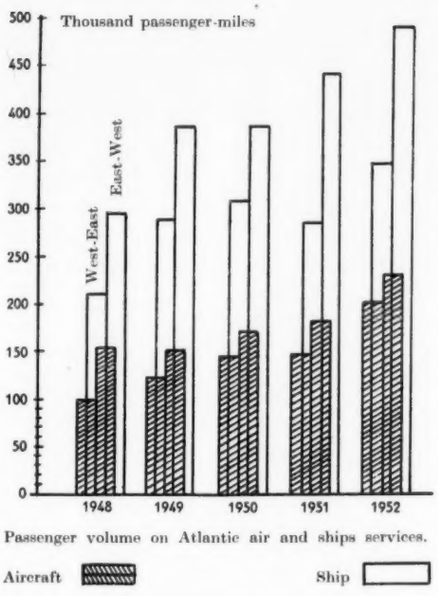
East-West direction :
shipping : July to October (four months),
aircraft : August and September.

During these summer months ships are booked out to the last berth. Demand considerably exceeds supply in June and August, particularly during the second half of August, as the summer season in American business life ends about September 1st. Air carriers have found that during this period a substantial portion of those who fail to get ship's passages take the aircraft (a circumstance which is by no means limited to Atlantic services, but which is found in all regions where traffic is seasonal).

Unfortunately no exact details are available for the unsatisfied demand for ship's passages. Surprising as this may seem, even the most efficient statisticians have to work completely in the dark on this point, as the passengers turned down by one shipping line immediately try to get passage on another and generally put themselves on the waiting lists of several lines. Sea voyages, too, are often postponed, if passages cannot be obtained for the desired dates. All who are employed in shipping business are well acquainted with these facts. All know that seasonal booking for Atlantic liners spreads over several months and is complicated by "wanderings" from one line to another.

This superficial review will suffice to show why all efforts by the statisticians must fail.

Nevertheless, the following statements most



Passenger volume on Atlantic air and ships services.

Aircraft ▨ Ship □

probably correspond fairly closely to the true facts :

During medium travelling times (West-East : May, August, September ; East-West : June, July, October) air services account for the following percentages of total atlantic traffic : West-East 50%, East-West 44%.

During the high season (West-East : June, July; East-West: August, September) this percentage rises to about 60% in both directions.

Assuming that the advantages of air travel remain roughly constant throughout the summer season, something like 30,000 ship's passengers changed over to the aircraft in 1952 (including 8,000 to 10,000 first class passengers). The increase in seats offered after the introduction of tourist class services made it possible for this extra traffic to be absorbed ; it would not be justifiable to say that this movement was due entirely to the reduced tourist air fares. The airlines were undoubtedly not in a position to handle all the traffic turned down by the shipping lines, the volume of which it is impossible to estimate. If the total number of passengers unable to get ship's booking is taken as 50,000, there is nothing to prove that half of them would not have tried to go by air in any case.

Profit and loss account of tourist services

The "tourist class experiment"—the initial period of which was not unfavourable for the airlines—undoubtedly entails a certain risk.

If in 1953 or 1954, because of international economic conditions, the general on-season demand for passages were to fall—even by as little as 10%—the airlines could no longer count on surplus ship's passengers. Tourist services would no longer pay, as it is essential for them to operate to capacity during the summer season to compensate for the mediocre traffic figures during the five winter months.

Altogether Atlantic tourist services in 1952 recorded 190,000 passengers, including :

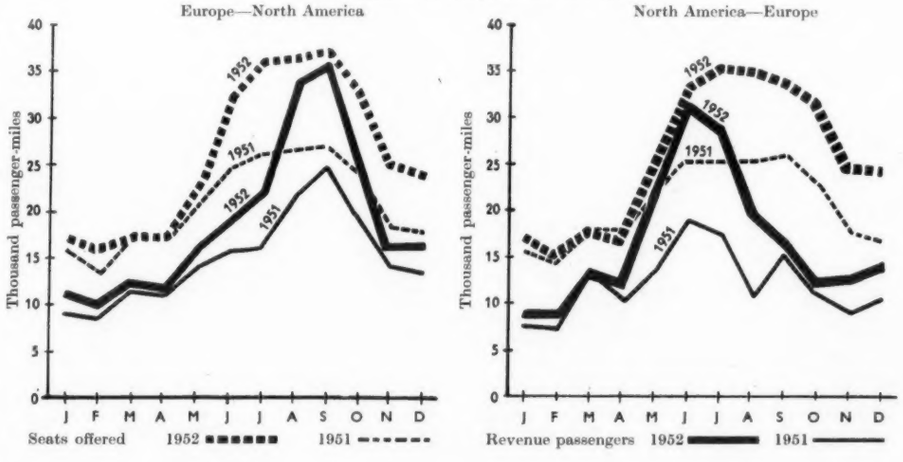
130,000 transferred from first to tourist class,
20,000 transferred from ship to air,
40,000 new Atlantic travellers with limited means and time at their disposal. Of these 40,000 new passengers, by no means all flew in both directions. On the contrary, it was found that a great many passengers took the boat one way and the aircraft the other.

This changing over from one means of transport to another—for which precise figures are lacking—shows that these two models of travel, competive in appearance, are in practice complementary. Nevertheless our figures give a general indication of the effects of the tourist class on the profitability of Atlantic transport.

First and foremost, the average number of passengers carried per flight in first-class was 30% lower than the average carried in tourist class. This percentage corresponds fairly exactly to the difference in price between the two classes (for example, Paris—New York : first class, 145,300 francs ; tourist class, 101,500 francs). It follows that the mean revenue per service was roughly the same for the two classes.

As passenger load factor on first-class services did not vary substantially between 1951

North Atlantic air passengers in 1951 and 1952



Cabin of one of Sabena's Douglas DC-6B tourist class aircraft.

Traffic figures for Atlantic passenger operations (both directions)

	1951	1952		
		First Class	*Tourist Class*	*Total*
Passenger flights	10,631	7,905	4,332	12,237
Seats offered (in thousands)	501	364	262	626
Passengers (thousands)	330	243	189	432
Average per aircraft: Seats offered	47	46	61	51
Passengers	31	30.7	43.7	35.3
Load factor	66%	67.3%	72.3%	69%

First class cabin in a Sabena DC-6B.

and 1952, it follows that revenue would have increased in proportion to :

1. increase in frequency of services,
2. approximately 5 % increase in first-class fares.

Incidentally, the latter increase was designed to compensate for the reduction in the number of sleeper chairs per aircraft and a general increase in comfort.

The value of the introduction of tourist class services can therefore be expressed in the following table :

	Increase in revenue on Atlantic services in 1952, compared with 1951	Increase in operating costs in 1952, compared with 1951
Without introduction of tourist class	+ 13%	Increase corresponding to increase in services
Estimated results due to tourist class	+ 21%	Increase corresponding to 15% increase in services

Thus an increase in costs corresponding to an increase of 3 % in the number of services enabled an extra 8 % of global revenue to be obtained. As the increase was only in direct operating costs, operations were in reality more profitable than the above figures would indicate.

It would, however, be wrong to restrict an examination of the real advantages gained by the airlines from the tourist class experiment on the North Atlantic to this aspect. The introduction of tourist services enabled the airlines to reach new groups of travellers, which, it may be hoped, will remain faithful to them. We must also not lose sight of the inter-action of Atlantic and European regional services. In the minds of the operators, the European networks of companies operating Atlantic services are designed essentially to provide traffic for the latter. Conversely West-East Atlantic services bring an appreciable increase in traffic for the European services. An enquiry made among Americans arriving in France by air in 1950 revealed that most of them intended to visit two other European countries as well, generally also by air.

Assuming that the creation of the tourist class produced a new clientèle of more than 20,000 Americans to come to Europe, this implies an increase of 30,000,000 passenger-kilometres, at least, on the European sector, or an extra revenue of $1,500,000 to $2,000,000. It is not surprising that the European airlines should have considered it advisable to extend the tourist class to their European services in 1953. The practice of the stop-over probably would have enabled the American airlines to carry all tourist passengers from America on their own European routes. Not to have extended the tourist class to their European network would have exposed European airlines to the risk of losing on their Atlantic services some of the American passengers who had hitherto given them preference.

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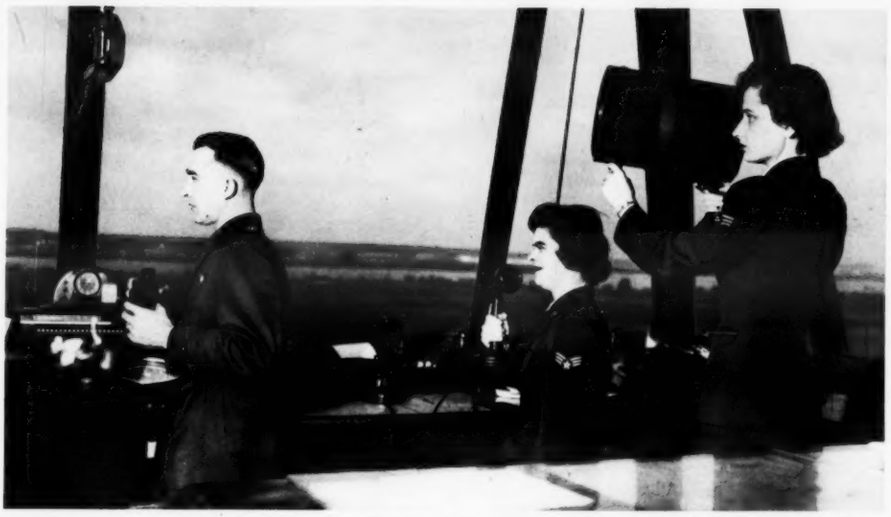
The results for 1953 will naturally provide a much more reliable basis on which to judge the value of the tourist class.

Enlisted women of the Army, Navy, Air Force and Marine Corps act as a colour guard, carrying the U.S. flag and the flag of the U.S. Secretary of Defence. The U.S. Capitol, Washington, forms the background.



Two women non-commissioned officers of the W.A.F. act as control tower operators at Bolling Air Force Base, Washington.

An Air Force physical therapist attends a bed patient in a hospital in the U.S.A. She belongs to the Medical Specialists Corps which also includes occupational therapists and dieticians.

Career Women in Uniform

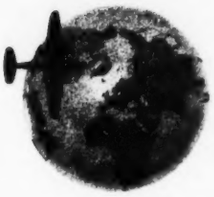
Women are still being recruited as officers and enlisted personnel of the U.S. forces in spite of the new savings in defence spending. There are literally hundreds of specialized tasks to be performed by women, including medicine and surgery, nursing, photography, communications, control tower operations, information and education, varied scientific fields, etc. The U.S. forces have nine women's components, including the Women's Army Corps (W.A.C.), the Navy's WAVES, Women in the Air Force (W.A.F.), Women in the Marine Corps (W.M.C.), several nurses corps, etc. What some of them do is shown on this page.

A dietician of the Army Medical Specialists Corps inspects food to be served to patients at Walter Reed Army Hospital, Washington, D.C.

An enlisted woman in the U.S. Marine Corps receives instruction in teletype operation at the Marine Corps School, Quantico, Va.

Two members of the Women's Army Corps collect information for the compilation of maps by a topographical unit at the Engineer Center, Fort Belvoir, Virginia.

Photography is one of the fields open to enlisted women in the U.S. armed forces. Here a Navy WAVE is operating a photomicrography camera at the Navy's extensive photographic centre.



What's in the Air ? *

AVIATION POLITICS

● Come-back in the European arms industry

Western Europe's industrial revival during the last three years has been described in a report issued by the Mutual Security Agency. This 42-page report, entitled "European Industrial Projects," states that from mid-1952 to mid-1953 alone Western Europe produced $3,000,000,000 worth of defence goods, or nearly three times as much as during the 1950-51 year, when the post-Korean defence build-up was just getting under way. Despite the fact that European countries have put up the equivalent of four dollars for every U.S. dollar spent, "this mounting defence production would not have been possible without the financial assistance of the people of the United States." A large portion of the U.S. aid had been channeled through 134 major projects, chiefly comprising the reconstruction of war-damaged plants, the modernization of others and the construction of new factories. These projects "have cost an estimated $2,600,000 equivalent, representing a capital outlay by Europeans for plant expansion of more than $2,000,000 equivalent in their resources and more than $500,000 authorized under U.S. economic and defence support."

● Congress passes Foreign Aid Bill

Both Senate and House of Representatives have approved the 1953-54 Foreign Aid Billfor $4,530,457,999, with a big majority. This exceeds the sum originally voted by the House by $500,000,000 but is $600,000,000 less than the funds asked for by President Eisenhower and $3,000,000,000 less than the original sum demanded by the Truman Administration.

● U.S. Defence Budget

The U.S. 1953-54 Defence Budget, reduced from the $57,500,000,000 originally requested by the Truman Administration to $34,371,541,000, was passed by both Houses of the Congress at the end of July. Funds approved for the three defence forces are : U.S. Air Force $11,168,000,000 ; army $12,995,406,000 ; Navy $9,483,310,000 ; Defence Department administration etc. $769,825,000.

* Extracts from "Interavia Air Letter," daily international news digest, in English, French and German. All rights reserved.

Sabena, the Belgian airline, started using the new Brussels heliport for its Brussels—Lille service on August 1st, 1953.

Swiss sports flying loss. Eduard T. Lauber, Vice-President of the Aero Club of Switzerland, was killed on August 4th, 1953, when his German *Spatz* glider crashed near Samedan.

Dr. Alphonse M. Ehinger, member of the board of Swissair, died of a heart attack on August 2nd, 1953, at the age of 61. Dr. Ehinger, who had been a member of Balair (Swissair's predecessor), was Swissair's delegate to the pre-war International Air Traffic Association, of which he was President for one year.

Professor Dr. Otto Riese (centre) who occupied the chair of Air Law at the University of Lausanne up to 1951, when he accepted an invitation to join the German Federal Court at Karlsruhe, has been appointed to the High Court of the European Coal and Steel Community in Luxemburg.

SERVICE AVIATION

● B-47 Atlantic record

A U.S. Air Force Boeing B-47 *Stratojet* six-jet bomber set up a new record for the Atlantic crossing on July 28th, by flying from Limestone (Maine) to Fairford (Gloucester)—a distance of 2,925 miles—in 4 hours 46 minutes at an average speed of 613 m.p.h.—The previous record of 5 hours 22 minutes was set up on June 5th, 1953, by another *Stratojet* on the same route.

● American hydrogen bomb

In its report for the first half of 1953, the U.S. Atomic Energy Commission states that the development of atomic weapons had "substantially advanced" in the first six months of this year, and that it would soon be ready to produce all materials necessary for the manufacture of the hydrogen bomb. The new A.E.C. Chairman, Lewis L. Strauss, played a leading role as an original member of the Commission in 1946 in persuading President Truman to authorize the all-out attempt to develop the H-bomb.

● Russian long-range bombers for China

Unconfirmed reports from Hong Kong claim that the Soviet Union recently delivered a first batch of long-range bombers, of undisclosed type, to the Chinese People's Republic. Twelve of these bombers are said to be stationed at a military airfield about 40 miles southeast of Peking. The Red Chinese Air Force's fleet had previously consisted of MiG-15 fighters and a small number of medium-range bombers.

AIR TRANSPORTATION

● O.E.E.C. eases air travel

The member countries of the Organization for European Economic Cooperation (Austria, Belgium-Luxemburg, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, the Netherlands, Norway, Portugal, Sweden, Trieste, Turkey, United Kingdom) decided at their meeting in Paris to grant the same payment facilities to air travellers as are now available to travellers by surface means. In future nationals of these countries will be able to buy air tickets in the currency of either departure or destination country. For example, a Dane will be able to buy a ticket from

Six months to the day after the placing of an off-shore contract with Fiat, Mutual Security Agency delegate Shuff was able to take delivery at Fiat's Turin plant of the first Italian-built parts for the Allison J-35 turbojet engine.

Paris to The Hague in the French capital for French francs, or an Italian a Rome-London ticket in the British capital for sterling. However, France has reserved her position as regards this latter provision, and Greece did not agree to either proposition. The O.E.E.C. Council also introduced facilitations for the transfer of passenger, freight and excess baggage revenues.

● J. W. S. Brancker gets I.A.T.A. post

The International Air Transport Association reports that J. W. S. Brancker—hitherto General Manager, International Affairs, for British Overseas Airways—has been appointed to the new executive post of Traffic Director to I.A.T.A. In this capacity he will be responsible for the organization and supervision of I.A.T.A. Traffic Conferences. Brancker's father, Major-General Sir W. Sefton Brancker, was one of the founders of the old I.A.T.A. and drafted its statutes, which were signed in 1919.

● Sabena's international helicopter services

Sabena opened a helicopter mail service between Brussels and Lille on August 5th. A passenger service is to be operated from September 1st.

● Reorganization of Turkish air transport

The Turkish National Assembly has voted the sum of 38,000,000 Turkish pounds (roughly $15,000,000) for the reorganization of the Turkish State airline, Devlet Hava Yollari, and in particular for the modernization of its air fleet—at present 25 Douglas DC-3s. Riza Cerçel, the company's Director General, who sent *Interavia* this information, stresses that the aim of the reorganization is to separate the administration of commercial flying from that of the civil airports. Both are today governed by the airline, which comes under the Ministry of Communications and performs the double duty of Turkish air carrier and civil aviation authority.

INDUSTRY

● U.S. West Coast "tax battle"

The United States taxation authorities have estimated that 60 aircraft firms in the Los Angeles region, including Douglas, North American, Northrop and Lockheed, hold raw material stocks to a total value of more than $250,000,000. The firms are now being asked to pay taxes amounting to $8,000,000 on these stocks. Financial experts estimate the value of stocks held by Douglas to be $31,000,000, Lockheed $18,000,000, Northrop $6,200,000. Up to the present aircraft manufacturers have refused to pay taxes on raw material stocks, arguing that they are the property of the Federal Government (under defence contracts). Tax officials, however, claim that the firms hold "taxable rights in the properties including the right to make a profit on the fabrication of the materials into aeroplanes." The aircraft industry is expected to refuse payment of the new tax and to go to court to get the matter settled once and for all.

Boeing C-97G transport tanker: series G of the Boeing C-97 *Stratofreighter* multi-purpose cargo transport is being delivered in large numbers to the U.S. Air Force. It will be used above all by the tanker units of Strategic Air Command for in-flight refuelling of bomber squadrons (B-47B) and escort squadrons (F-84G). Other utilizations (SAC or MATS): military goods transport, troop transport and evacuation; ambulance work.

● United licence for de Havilland

United Aircraft Corporation has granted The de Havilland Propellers Ltd. licence rights in the British Empire and other undisclosed countries, for a refrigeration unit for fighter cockpits.

Colonel Edgar Primault, Commanding General of the Swiss Air Corps in 1946, celebrated his 60th birthday on July 26th. Colonel Edgar Primault is Vice-President of Swissair, President of the Swiss Chamber of Watchmakers, President of the Office Suisse d'Expansion Commerciale, etc. *Interavia* has had the honour to count him as a member of its Administration for many years.

● Centralization of British radar research

Minister of Supply Duncan Sandys has announced that British radar research has been reorganized to enable efforts to be concentrated on the development of methods for the control of guided missiles and for defence against attack by remote-controlled weapons. The Ministry of Supply's two electronic experimental stations at Malvern—one of which has been primarily engaged on research for the Army, and the other for the Royal Air Force and Fleet Air Arm—have been amalgamated. The new establishment is to be known as the Radar Research Establishment. W. J. Richards, formerly Chief Superintendant of the Malvern Telecommunications Research Establishment, has been appointed Director of the new establishment.

TECHNICAL

● The Handley Page H.P. 80 Victor

First pictures and information released on the unusual Handley Page H.P.80 *Victor* four-jet bomber indicate that it has a torsion-box spar following the line of the "scimitar" wing. The inner part appears to be of relatively shallow chord, but is very thick, with hexagonal apertures for the air intakes to the jet engines. The next section is evidently broader and thinner. For the skin extensive use has apparently been made of double sheets with corrugated separators, and stiffeners parallel to the centre line.

The H.P.80's power controls consist of electro motors (in duplicate), hydraulic pumps and hydraulic jacks. Large-diameter push-pull controls (in light metal tubes) pass the pilot's control deflections to the servos, a somewhat bulky method of transmitting signals. Artifical "feel" appears to be provided by an air speed indicator capsule operating a variable spring.

In view of the high operating altitude an efficient air-conditioning plant is fitted for pilot's cabin, bomb aimer's and other crew stations. Air is bled off from the jet compressors and its temperature regulated by turbo-expanders and heat-exchangers. Hot air from the engines is also used for de-icing the wings, while an independent heater in the fin, with intake in the fin leading edge, de-ices the tail unit.

● Northrop electronic building blocks

Northrop Aircraft Inc.—one of the many American firms engaged on quick replacement plug-in equipment units—has recently brought out what it calls "electronic building blocks" with which the operation of new aircraft can be rendered progressively automatic. Provision can be made in the design of new aircraft types for subsequent installation of the standardized elements.

● Marquardt ramjet laboratory

Roy Marquardt, President of Marquardt Aircraft Co., Van Nuys, California, was authorized by the U.S. Air Force in mid-July to show a group of engineers and aviation writers his new $3,500,000 ramjet research laboratory where test runs can be made up to Mach 4. Consisting of an array of test cells of varying speeds, the laboratory is supplied by a high pressure tank which stores up to 50,000 lbs. of air. Nevertheless, because of the high air consumption, ramjet test runs last less than a minute. During this short time tens of thousands of dial and manometer readings are photographed for subsequent evaluation.

The Saab-32 Lansen two-seater ground attack aircraft built by Svenska Aeroplan A.B. has two boundary layer fences.

Book Reviews

Zeitschrift für Flugwissenschaften.—Published by Prof. H. Blenk for the Wissenschaftliche Gesellschaft für Luftfahrt, Brunswick.

This new monthly journal, the first issue of which appeared in June 1953, is virtually a revival of an older publication which fell victim to the events of the past two decades. The "Zeitschrift für Flugtechnik und Motorluftschiffahrt" edited by L. Prandtl, F. Bendemann and W. Hoff before World War II was suppressed at the end of 1933, after an existence of 24 years. The *Wissenschaftliche Gesellschaft für Luftfahrt* (Society of the Aeronautical Sciences) was also obliged to dissolve in 1936. The reappearance of this technical magazine will provide a welcome mouthpiece for German aeronautical science. Ba.

Review of Current Research and Directory of Member Institutions 1953.—Issued by the Engineering College Research Council of the American Society for Engineering Education.—State College, Pennsylvania, 1953. (Price $2.50.)

A reference book which gives detailed information on personnel and curricula of all engineering colleges in the United States. The list covers 103 scientific institutes, 7,500 research projects, 13,000 scientists engaged on these projects. Needless to say, aeronautical research occupies a substantial portion of the book. Ba.

Navigation Aérienne Astronomique, by Max Dévé and Raymound Faure. Gauthier-Villars, Paris, 1952. (French, 268 pages, price 2,400 francs.)

In the good old days of sailing ships the captain would get out his sextant at stated times and shoot the sun. In flying, however, the great speed of present-day aircraft has caused the sextant to fall into disgrace, as its use is too time-consuming. The pilot uses the excellent radio service, whose stations throughout the world give him his exact position and course within a few seconds. The authors of this book, however, warn navigators not to forget their celestial navigation, pointing out that an aircraft, even in peace-time, may be cut off from communication with ground stations. The basic principles of celestial navigation, and the instruments, tables, etc. it requires, are therefore given in readily-acceptable form, and the text, though compiled with scientific clarity, is made interesting reading by the inclusion of historical references and anecdotes.

The writers, who flew throughout the world during aviation's "heroic age," when they had to find their way without the help of a ground organization, are particularly qualified to write on the subject. The book is the first complete work in French on celestial navigation to appear since the end of the war. La.

L'Hélicoptère, Théorie, Pilotage et Utilisation, by Jean Moine.—Société Fenwick (French, 208 pages).

A bare twenty years ago the helicopter was an awe-inspiring contraption with a bewildering collection of wires, bearers and steel tubes, above which turned a sort of wind-mill. Only a few initiated believed in the future of this aircraft. Shortly after the end of the war, however, the helicopter developed at an astonishing rate and became a rational, almost handsome apparatus which is finding increasing application in both military and civilian flying. Moine's book fills the need for a readily understandable work on the subject in France, giving as it does, a well-illustrated description of all aspects of helicopters : production, aerodynamics, control, operation, etc. It also includes a review of all helicopters in service or under development today. La.

Flugzeugtypen 1953, by Karlheinz Kens.—Carl Lange Verlag, Duisburg, 1953. (German, 80 pages : price DM 4.80)

The author gives a review of the most important gliders and sports aircraft made in Germany and elsewhere. Each aircraft type is given a brief description, a picture (three-view drawing) and a list of the most important characteristics and performance figures. These details are supplemented by a survey of the German accessories industry, which is already quite active again. Ba.

The Development of Rules to Govern International Aviation Communications, by Prof. D. Goedhuis in "Transport and Communications Review." July/September 1952.

Although it is not normally our custom to review articles in periodicals under this heading, Professor Goedhuis's article would appear particularly worthy of mention on the eve of the 7th session of the I.C.A.O. Assembly at Brighton (June—July 1953). Once more the well-known Dutch air law expert examines the reasons for the present economic disorganization in world air transport. He outlines, in graphic fashion, progress made in the questions which underly all effective planning for fruitful collaboration in air transportation on a world-wide basis : sovereignty (landing rights for scheduled and non-scheduled airlines ; customs and police barriers) ; prospects for a multi-lateral agreement ; internationalization of long-range traffic ; Sforza plan for unification of European air transport, etc.

In this article the Dutch school of air law shows once again that it is tireless in the struggle for the rationalisation of world transport. He.

Humor in der Technik, Vol. II, by Hans Tillmann and Dr. Gerhard Classen. Vulkan-Verlag Dr. W. Classen. Essen, 1953. (German; 304 pages; price DM 16.60)

A book which spreads good humour—even among the driest of engineers. Aphorisms, humorous stories and verses by the best writers, covering the whole realm of engineering from Munchhausen's "passenger cannon ball" to the noise of an engine test bed and the deficiencies of modern achievements. Flying comes in for its full share, with a chapter entitled "If nothing else helps, you must fly !" devoted to it. He.

Books received

Publications of the International Civil Aviation Organization.—Published by I.C.A.O. (in English, French and Spanish), Montreal 1953 :

Facilitation (Standards and Recommended Practices) : Annex 9 to the Chicago Convention.

Aeronautical Telecommunications (Standards and Recommended Practices) ; Annex 10 to the Chicago Convention.

Communications Procedures (Field Manual No. 1) ; Doc. 4478-COM/501/2.

Radiotelephony Procedures ; Doc. 7181-COM/546/1.

Terrain Clearance and Vertical Separation of Aircraft.—Altimeter Setting ; Circular 26-AN/23.

Aircraft Accident Digest No. 3, Circular 31-AN/26.

Report on the Scandinavian Airlines System (SAS), Circular 30-AT/5.

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Publications scientifiques et techniques du Ministère de l'Air.—Distributed by Service de documentation et d'information technique de l'Aéronautique, Paris :

No. 271. *Les Principes physiques de la formulation des lois expérimentales ; Conséquences pour la philosophie des sciences ; Calcul effectif de différents types de lois,* by Pierre Vernotte.

No. 272. *Etude générale de l'écoulement d'un gaz à travers une tuyère quelconque et du passage par la vitesse du son (en régime permanent ou quelconque avec apport de chaleur et réaction chimique éventuels),* by Max Serruys.

No. 273. *Température et équilibre thermique dans une flamme de diffusion,* by Pierre Barret.

No. 274. *Le statoréacteur supersonique aux nombres de Mach modérés,* by Max Salmon.

No. 275. *Contribution à la théorie des ondes liquides de gravité en profondeur variable,* by Maurice Roseau.

No. 276. *Contribution à l'étude de l'intensité des bandes d'absorption infrarouge,* by Gilbert Amat.

No. 277. *Régulation hydraulique d'alimentation des turbomachines,* by Basile Demtchenko.

No. N.T. 45. *Le rôle de la régularité dans le calcul numérique,* by Pierre Vernotte.

No. N.T. 46. *Le point de vue du physicien dans le problème du lissage des courbes expérimentales,* by Pierre Vernotte.

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Technische und Volkswirtschaftliche Berichte des Wirtschafts- und Verkehrsministeriums Nordrhein-Westfalen, edited by Min.-Dir. Dipl.-Ing. Brandt ; No. 14 : *Entwicklung und Stand der Verkehrsflugsicherung,* by Dr.-Ing. E. Rössger (printed as manuscript).

Error in page numbering

We hope our readers will forgive us. The silly season must have affected our make-up man, for he began numbering the pages of both July and August issues with the same number.

The August issue, which is numbered pages 361 to 428, should have been numbered 417 to 484. When the error was discovered it was too late to correct it.

The present issue is numbered 485 to 544, so as to keep the index straight at the end of the year.

Design for Production

BY W.E.W. PETTER, C.B.E., B.A., F.R.Ae.S., MANAGING DIRECTOR OF FOLLAND AIRCRAFT LTD., SOUTHAMPTON

In our issue on " Short-Life Aircraft " a year ago (No. 7, 1952) we broke a lance for the simple, cheap but efficient interceptor, fitted with short-life power plant, for home defence : " The West turns out its Pockets . . .", " Genesis of the He 162 Volksjäger *. . .", " Just Why are Aircraft so Costly ? . . ." and so on. We raised the question of whether the best solution would not after all be provided by high performance fighters* and *short-life aircraft, with the former being used for all-weather fighter operations, defence against high-flying bombers and long-range reconnaissance aircraft, escort duties, and the latter for interception or perhaps to support the ground forces. A possible arrangement, finally, would be to use a single path-fider fitted with complete modern radar equipment to guide whole " swarms " of short-life aircraft to their targets.*

The idea of short-life aircraft now appears to have gained ground during the past twelve months among certain manufacturers and designers with a big part to play in Western air armament. It appears to be widely believed that a new general war in the next five or ten years is not an impossibility—at any rate this was the view help up to the death of Stalin. In such a case, what would the West have to oppose to a " 1,000-bomber day raid " by four-engined Tupolev Tu-4s (former Superfortresses) *with a powerful MiG-15 escort ?—To shoot down a mere fifth of the attacking bombers, we must have a fighter superiority of 4 : 1, by World War II experience. Working on the reasonable assumptions that, on the one hand, Russia is unlikely to make great advances in fighter design during the next ten years and that, on the other hand, it should be possible to build a light-weight fighter for close-range interception that would be equal to the MiG-15 and be suitable for mass production, designers in France, Italy and Great Britain have brought out—almost quicker than thought—a series of promising projects for short-life " de-refined " fighters.*

There is, for example, the SE 5000 Baroudeur, *a model of which was shown in Paris. It was designed by W.J. Jakimiuk, the Polish-Canadian designer of the* Chipmunk, *the* Beaver *and the* Vampire-Trainer, *to basic principles laid down by Georges Héreil, SNCASE's Chairman. Then Marcel Dassault has obtained the licence for the Armstrong-Siddeley* Viper *short-life engine and is to fit it—with increased thrust—in a light interceptor fighter. Finally the new firm of SFECMAS (formerly Arsenal) is working on a light delta-wing fighter to a design of Engineer General Vernisse and Jean Galtier.*

Another promising project, finally, is the FO 141 Gnat *interceptor fighter now being prepared by the British firm of* Folland Aircraft Ltd. *Its designer is the company's Managing Director,* William Edward Willoughby Petter, *who a few years ago was chief engineer to English Electric Co. and designed the* Canberra *twin-jet bomber for them. With its swept wing of very small span and low aspect ratio, with swept-back single tail unit, nose-wheel undercarriage and short-life engine, and armed with two 30-mm cannon and rocket projectiles, the* Gnat *is said to have an operational gross weight of not more than 2,500 kg., though it is expected to reach altitudes of more than 12,000 m. and max. speeds of around Mach 1. An important point, too, is that it will take only about one-fifth as many man-hours to produce as a traditional fighter of comparable performance, namely about 4,000, as compared with 20,000.*

The following is the text of a lecture given by the designer of the Gnat *at this year's meeting of the* Association Française des Ingénieurs et Techniciens de l'Aéronautique *in Paris on June 29th, 1953.*

THE EDITORS

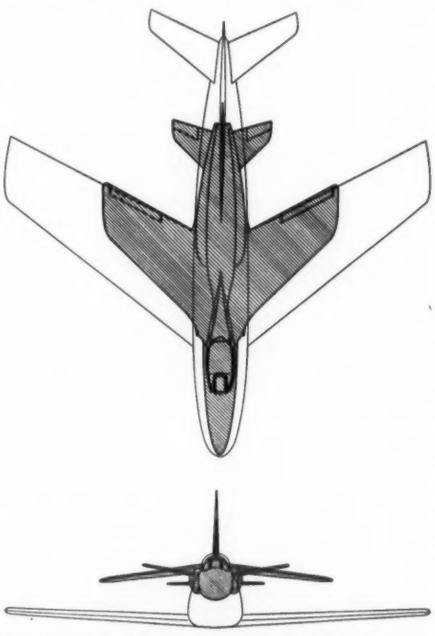
Light Weight Design the Key to Large Production

Much can be done by a good basic layout and intelligent detail design, to achieve simplicity and low cost, but when all has been attempted, the final difference of cost—or man hours, of designs evolved by competent designers strictly to fulfil a given requirement, will be only marginally different, perhaps 20 %.

The problem we face today, however, is one which cannot be solved by improvements of this order. We have reached the point where the capital, tooling and production costs of fighter aircraft have risen so that it is impossible to build large numbers at all, and indeed the development of manufacturing techniques requires an ever larger number of complex machines, whose cost has risen many times over since the War. The tooling up for production now takes two years, so shortening seriously the useful operational life of the machine. Because of these heavy demands on money and skill, it is becoming increasingly difficult for many countries to produce their own aircraft. Even those who do, can no longer achieve the benefits of mass production, the quantities being so small that they are still in the process of learning at the end of the order. The volume and great complexity of equipment carried is a contributory factor and the cause of many hindering modifications.

It is proposed therefore to make our theme a brief examination of the benefits which could derive from producing an aircraft of much smaller size in very much larger quantities. Having, we hope, proved this point, we will examine the distribution of weight in the various groups between large and small machines, when we shall find that although we can and must obtain a better load carrier in the small machine, this need not be at the expense of power. *For performance must on no account suffer—it must and can be comparable with the best.*

We will take, for the sake of example, a small fighter aircraft weighing about 2,500 kilos, and compare it with a contemporary design of a more normal weight of 7,500 kilos. We select this size because it can carry a military load of 500 kilos, which exhaustive analysis shows to be capable of satisfying the majority of day-fighter requirements. The comparative sizes of the two machines, which will be of equal wing loading, are shown in Figs. 1 and 2. The weights quoted are for machines without overload tanks or reheat—although the addition of this equipment would not affect the broad conclusions reached.



Figs. 1 and 2 : Comparative sizes of a high-performance fighter and a " de-refined " interceptor, assuming similar wing loading.

Cost Comparison

Let us assume that there is an overall sum to be expended of £6,000,000 and see how many of each type of machine we can buy with this sum. The *cost in manhours* of the two types as production proceeds is illustrated in Fig. 3.

These curves, in which hours are plotted against numbers, are based on much experience of quantity production of aircraft components. The upper curves show at any stage the hours required to produce 200 of the larger machines; because of complexity and the impossibility of tooling adequately, the rate of cost decrement will probably follow an 85 % curve—by which is meant that each time the quantity of aeroplanes is doubled, the cumulative average manhours will be 85 % of the cumulative average manhours per aeroplane for the quantity which was doubled. By plotting numbers logarithmically, our curve becomes a line of constant slope. However, in order that we may not be suspected of partiality, a better rate of decrement—80 %—has been assumed on the graph.

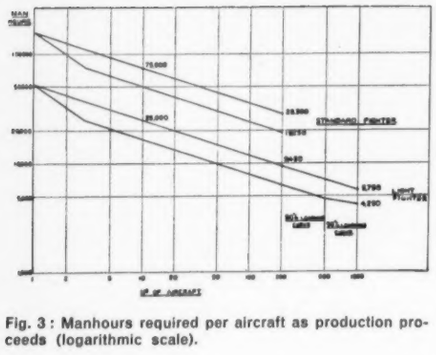


Fig. 3 : Manhours required per aircraft as production proceeds (logarithmic scale).

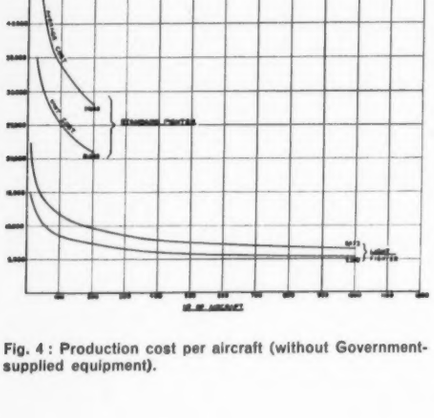


Fig. 4 : Production cost per aircraft (without Government-supplied equipment).

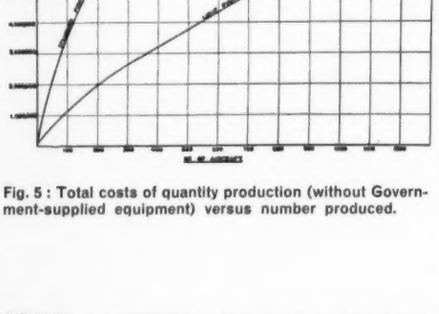


Fig. 5 : Total costs of quantity production (without Government-supplied equipment) versus number produced.

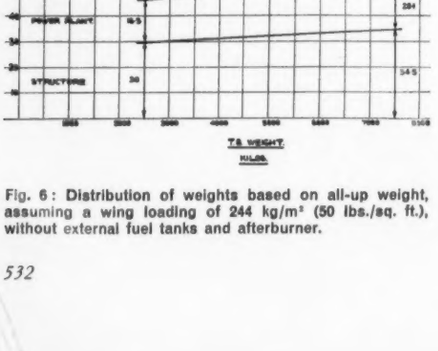


Fig. 6 : Distribution of weights based on all-up weight, assuming a wing loading of 244 kg/m² (50 lbs./sq. ft.), without external fuel tanks and afterburner.

The lower curves snow the cost in manhours of the smaller machine, of which we hope to produce 1,000. In these, we should expect a more rapid rate of cost fall, the larger quantity justifies continuous improvements of method and the reduced complexity gives less opportunity for modifications. We have however, assumed up to the 500th aircraft an 80 % curve, which has been frequently realized on straightforward production in large quantities, and a reduced rate of decrement, 90 %, from the 500th onwards.

Comparing the upper and lower curves, we see the benefit of large scale production. Taking first the full lines, the cumulative average manhours on the *large machine* at the 10th and 200th are respectively 75,000 and 28,300—while on the small they are 25,000 and 9,450 respectively. So far we have therefore only realised a 3 : 1 reduction. But at the 1000th small machine we have lowered the average hours to 5,750, i.e., a fifth of that of the 200 large machines.

The next diagram (Fig. 4) shows the *average and unit costs* plotted against a normal arithmetical scale, and this brings out strikingly the tragedy of being forced to limit production of the large machine to a number where cost average is still falling rapidly. Finally the next diagram (Fig. 5), which shows cumulative total costs against number, indicates that *by spending £6,000,000 we can obtain 215 of the large machines or 900 of the small.* A further important bonus obtained is that the initial tooling will be only half as costly and lengthy for a thousand of the small machines as for 200 of the large ones.

Design Comparison

It may be asked, however, how it has been possible, while achieving an equal performance, to carry an effective useful load in so small a machine—particularly when past experience has often shown that the relatively higher proportion of pay load inevitable in the small machine, renders impossible the provision of adequate power, to the detriment of performance.

The distribution of weights is therefore plotted next (Fig. 6) on a base of all-up weight. We see that the useful load carried, i.e. fuel and military load, is indeed much greater for the small machine than the large, approximately 42 % against 33 % and this striking conclusion is attributable to three important factors, namely, the *structure*, the *engine* and *miscellaneous services*, all of which can be lighter for the small machine without sacrifice of performance or strength.

Structure : The structure, weight and complexity of the light aircraft we are considering all show considerable reductions over the larger aircraft, particularly in the wing design.* As the undercarriage track is a function of wing span, the undercarriage can be retracted into the fuselage, thus avoiding the discontinuity in the main load-carrying part of the wing structure that has made so many wing designs so difficult and heavy. Furthermore, it is found that adequate space is available in the fuselage for stowage of all the fuel required. Hence the wing structure may be built from tip to tip without discontinuity other than the inevitable change of direction due to aerodynamic sweepback.

The size of wing is such that adequate *strength and stiffness* can be provided by a *type of construction* (Fig. 7) in which skins are stiffened by separate stiffeners, a construction which is very much cheaper and easier to produce than the integral structures which are now being used for larger wings. Experience has shown that a considerable saving in manufacturing manhours can be achieved by replacing sub-assemblies, which in the past have been constructed from several different parts, by a single part. It is obvious of course, that the reduction in size makes the application of this principle considerably easier. A typical example, illustrated in Fig. 8, is the one-piece forged fitting of size approximately $70 \times 32 \times 7$ cm, which supports the wing on the fuselage, carries the undercarriage, and provides the rear gun attachment. This particular fitting, replacing several fittings in a larger aeroplane, can be made as a die forging, in which the number of parts is reduced to a minimum and machining may likewise be reduced. Again, the small machine by reason of its small dimensions and lighter loads, can make a very large use of pressed sheet metal parts, where built-up assemblies embodying castings and forgings would normally be required. Fig. 9 shows such a typical frame, a basic one-sheet metal piece supporting the front wing attachment.

Because of these and similar simplifications, it has been found possible to design a structure weight of 30 % as against nearly 34-35 % on the large machine. Should our light fighter be required for use as a naval fighter operating from aircraft carriers, the span would be such that wing folding would be unnecessary, thus showing a further saving in weight and complexity, together with considerable easement of maintenance difficulties.

Engine : It is undoubtedly possible to produce a light-weight engine, i.e. one having an exceptionally high thrust/weight ratio, with somewhat *less emphasis on consumption* in the small size ; a figure of 5 lb. of thrust for 1 lb. of weight being perfectly realisable with a *reasonably long life*. An improvement on the present figure of approximately 3 lbs. of thrust per lb. of weight for the large engine is also possible, although perhaps not in this degree, but the great cost of developing such large engines makes it inevitable that a compromise solution be produced. This in fact has occurred, so that our large engines are usually suitable for either bomber or fighter employment although these are greatly opposed in their needs. Were full advantage taken of this power plant gain, the disparity in power plant weight would be greater than the 16.5 % to 20 % shown. However, some of the potential gain has been used to increase the thrust/weight ratio in the interest of improving the climb performance beyond that of our latest fighters. Such a high ratio of thrust will allow heavy tactical overloads to be lifted off a short runway.

* It can be assumed that the wing loading of a light fighter will not exceed 200 kg/m², so as to ensure a high rate of climb and manœuvrability in high altitude combat. For an all-up weight of 2,500 kg therefore, the wing area would be only 12.5 m². To get sufficiently high speeds the wing *must* be thin and sharply swept, i.e. have a low aspect ratio. Span might be 6 m, for example (aspect ratio 2.88), which even with a thickness of 10 % will give enough spar height for light construction. (Heinkel's He 162 *Volksjäger* had straight wings with a wing area of 11.16 m², a span of 7.2 m. and an aspect ratio of 4.65 ; it weighed 2,495 kg. complete and carried 508 kg. of military load plus 475 kg. of fuel ; BMW 003 turbojet of 800 kg. static thrust). — Editors.

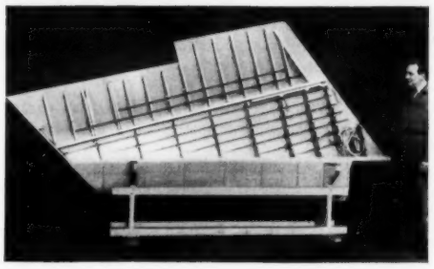


Fig. 7 : A simple wing construction gives the light-weight fighter adequate strength and stiffness, although the wing must be thin and sharply swept.

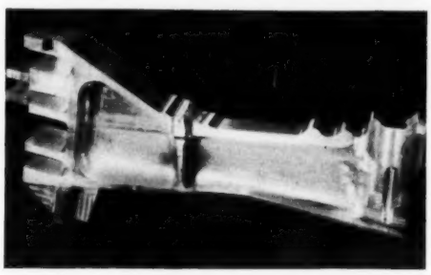


Fig. 8 : The fuselage-wing fitting in a light-weight fighter —a one-piece forged fitting—also carries the undercarriage and provides the rear gun attachment.

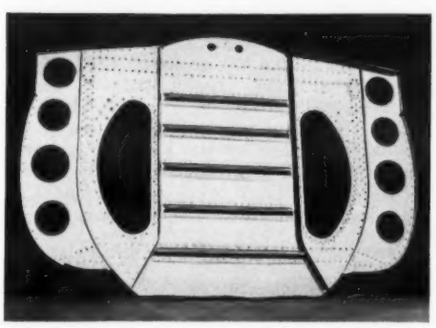


Fig. 9 : Many parts of the light-weight fighter can be made of pressed sheet metal, without using castings or forgings. Here, a one-sheet metal piece supporting the front wing attachment.

We have only to look at a *typical large axial engine* to see the very great cost and weight penalties of striving for the high compression ratio necessary for long endurance. Such an engine has 10 to 14 compression stages, two turbine stages and three bearings which lead to many thousands of moving parts, whereas *roughly half these numbers would be sufficient to produce a modern axial engine for fighter use* to take the place of the *Derwent* type which successfully exploited a compression ratio of about 4 : 1. Notwithstanding its excessive weight and large diameter, attributable to a centrifugal compressor and a design now nearly ten years old, this engine has proved that the high compression ratio is not necessary for fighter employment, and equally important, has shown the extremely low cost which can be realised when very large numbers of engines are made. The final cost of this engine was between £3,000 and £4,000, not much more than one tenth of the price paid today for our large engines.

Systems : Finally, the small machine can benefit from a more than proportional simplification of its services ; the hydraulic, electric and other systems, are an ever-increasing burden on a large machine, not only in manufacture but also in servicing in the field, and all this can be *greatly simplified* in the small machine. To quote an example : The *hydraulic system* (Fig. 10) for the 2,500 kg. fighter. This has a combined undercarriage and air brake system, the undercarriage together with a mechanically linked flap being driven by the single jack either fully down for landing or to an intermediate position for use as an air brake. The wheel doors are carried on the undercarriage directly, and due to a comparatively low wing loading, no wing flaps are necessary. So far as power controls are concerned, the moving tail is power controlled but the

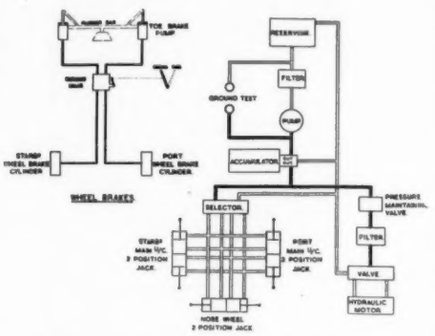


Fig. 10 : Diagram of the combined hydraulic system for undercarriage and air brakes (right) and hydraulic wheel brakes (left) in a light-weight fighter.

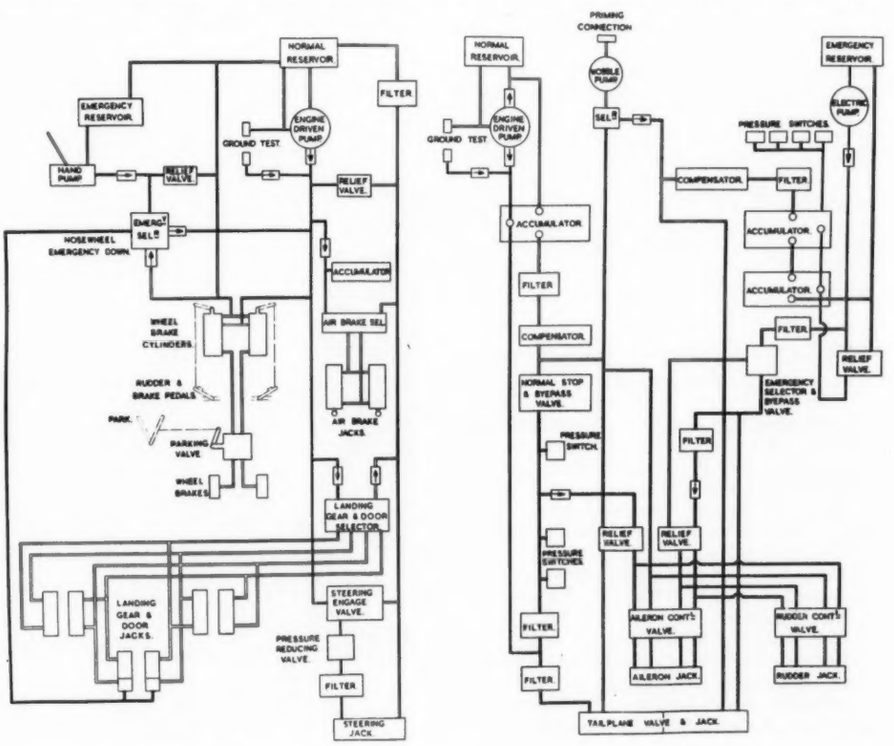
ailerons and rudder can still be worked directly. Toe brakes, similar to the system used on a car, replace the normal hydraulic power brakes.

A typical large fighter aircraft hydraulic system (Fig. 11) has a multitude of jacks and emergency systems, with power control inevitably on all surfaces. The above, and many other examples which could be quoted, in the electrical system and instruments, justify the claim that this weight-consuming group of items in the whole aircraft would only be 11.5 % in the small machine, as against 12.2 % in the large one.

Equipment : One would have liked, of course, to reduce the amount of equipment proportionately with the size of the machine, but since the *object of the fighter is to fight*,

Fig. 12 : Folland/SAAB light-weight ejector seat for fighters, with a weight saving of about 50 %.

Fig. 11 : Diagram of the complicated hydraulic system (left) and hydraulic power controls (right) in a high-performance fighter.



there is a limit below which it has been agreed this cannot be done. This limit would comprise two 20 or 30 mm. guns, or four .5-inch guns with reasonable ammunition ; adequate wide-range radio facilities, some form of navigational aid, and possibly provision for radar gun ranging as an overload.

It is agreed also that an *ejector seat* would be necessary although, even here, substantial weight saving can be achieved as compared with what has been common practice, firstly by good engineering design, secondly by the employment of a reasonable ejection velocity suitable for fighters, rather than a general purpose high velocity which might be necessary for larger machines, and thirdly, the elimination of ' frills ' such as the provision of ground adjustment for height instead of the gear for seat raising in flight. The next diagram, Fig. 12, shows the *Folland/SAAB seat* on which a weight saving of about 50 % has been achieved on the seat formerly used.

A *useful load of about 1,000 kg.*, representing about 40 % of all-up weight, will cover all the above essential military load, including the pilot, together with a rather better than normal internal fuel allowance, and we are led to the surprising conclusion that the small machine is a better carrier of useful load than the large. Admittedly, this derives in part from the employment of a more up-to-date, or at least specialised, engine, which however economics and time will probably prevent from being available in a larger size for the large fighter.

Conclusion

It is hoped we have shown that a major contribution to a reduction of cost can be achieved and, at the same time, a practical fighting weapon can be designed which will meet, if not all, a great many of the requirements for the operational functions of a day fighter.

We find that four or five times as many machines can be produced for a given cost, which makes possible efficient production in many countries which might otherwise not be able to contribute to their own and N.A.T.O. defence. The military man has made his contribution, but none the less he is able for a given cost to buy far more aircraft and ultimately to put into the air a larger number of guns than would have been possible along conventional lines.

Finally, he will make good use of the excellent pilots and man-power of our free world, an asset which we are in serious danger of losing because of our inability to build sufficient machines to use their skill and courage.

New Electronic Aids for Aviation

No attentive visitor to the 1953 Paris International Air Show or to this year's S.B.A.C. Display at Farnborough can fail to note the tremendous advance which has been made during the past few years in radio and radar engineering, and which is expressed in a vast array of new equipment and methods. Thanks to the use of radio waves, which cover all bands from the kilometre LF to the 3-cm SHF waves, and can be amplitude-modulated or frequency-modulated, pulse-spaced etc., air navigation *in particular has progressed from a hit-or-miss affair to an exact science.*

Progress in navigation in the air has gone hand in hand with the development of air traffic control *and* air space surveillance *from the ground. Precision radar equipment at airports enables* safe landings *to be made on* R/T instructions *in practically any weather. Radar instruments have also been developed which can warn pilots en route of dangerous* storm clouds *and enable storm-free alternative routes to be followed. Last but not least, mention should be made of a* miniature beacon for life jackets, *which will enable ditched pilots to be spotted and rescued without delay.*

● Société Française Radioélectrique's Navigation Instruments

A striking feature of the navigation equipment displayed on the joint stand of *Compagnie Générale de T.S.F.* (C.S.F. for short) and *Société Française Radioélectrique* (S.F.R.) in Paris was the great care that has been taken to combine *space and weight-saving structures* with the highest technical quality. This applies above all to S.F.R.'s new light radio compass and its UHF radio altimeter with buried aerials.

The radio compass weighs only 14 kg. (31 lbs.)—its parts are therefore all small in size, and it is made largely of light metal. Its frame is rectangular, of low height, so that no special blisters are required in the aircraft fuselage. The instrument can be used either as an *automatic* or a *simple* radio compass, and it can also be connected to the aircraft's automatic pilot. A working diagram is given in fig. 2.

S.F.R.'s *frequency-modulated radio altimeter* is also of extremely light construction, weighing only 13.5 kg. (30 lbs.). Transmitting and receiving aerials for this modern echo altimeter are housed in light metal containers and are completely buried in the wing, so that they create no additional drag. *Other technical data* : mean frequency 375 mc/s ; transmitter power approx. 0.8 W ; accuracy 10 % of the indicated altitude ; power supply 115 to 200 V alternating current ; working diagram in fig. 3. The radio altimeter has been thoroughly tested by the French Air Force and naval aviation and been passed as a very accurate and simply operated instrument.

Fig. 1 : A surveillance radar of particularly long range was recently installed at Orly International Airport by Thomson-Houston for Paris regional control centre.

Under a licence from the British firm of Decca Radar Ltd., S.F.R. is also making the latest version—Mark VII—of the well-known *Decca Navigator* (fig. 4), built for aircraft and therefore equipped with the automatic Flight Log. This equipment responds to the frequencies of all existing European Decca chains. Also, the new Decca chain built by S.F.R. in France, for the Ministry of Public Works, was taken into operation experimentally at the end of June.—The instrument's Flight Log, a marvel of precision, shows not only the aircraft's position on a special map at any given moment, but also the total distance made good by the aircraft, helicopter or ship. The figure readings of the three Deccometers are thus evaluated without delay. For medium ranges this Decca equipment is undoubtedly the most accurate navigation aid today available to air and marine navigation, and will be particularly valuable for the commercial helicopters of the future.

It should be added, in conclusion, that S.F.R. is also very active in the field of *ground radar equipment.* The mobile 10-cm field radar (with tent and independent current generator group) produced by this company was described in brief in No. 8, 1953 of *Interavia.* Another interesting product is the ER.221 radar transmitter-receiver for surveillance purposes (also 10-cm band), several hundred of which have been supplied to the *Armée de l'Air* and the *Marine Nationale* and to a number of foreign governments. The sister firm of C.S.F. recently built the *Paris-Lille telecommunications link* for numerous simultaneous telephone conversations, and created the ASV.23 system for instrument landings.

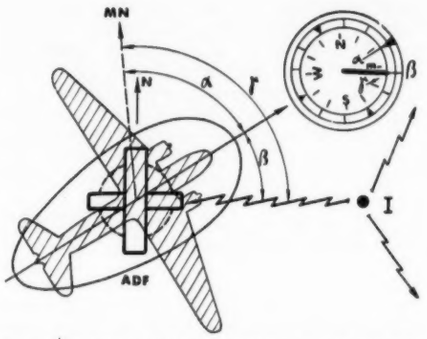


Fig. 2 : Principle of S.F.R. radio compass, which can be used as eigher manual or automatic equipment. The instrument shown top right gives the relative bearing β for transmitter I on the fixed outer scale, while the inner scale is turned manually or automatically to the aircraft heading (α ; under the triangular mark) and the angle (γ) between the bearing line and magnetic North is read off directly.

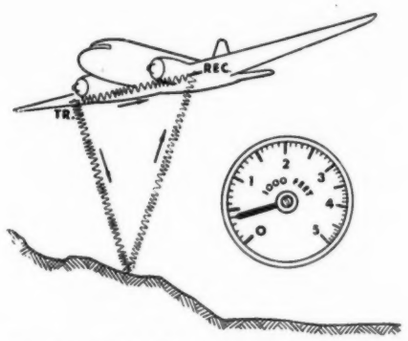


Fig. 3 : Diagram of S.F.R.'s frequency-modulated radio altimeter : for continuous determination of altitude above ground (terrain clearance), frequency-modulated continuous UHF waves are radiated from one of the aircraft's dipole aerials (their frequency being varied linearly between a maximum and a minimum), reflected from the ground and received by the second dipole aerial. The difference in frequency between the transmitted and reflected waves, which is proportional to the terrain clearance, is measured by an interference measuring device and indicated on the radio altimeter scale.

● Compagnie Française Thomson-Houston's Radar Equipment

A surveillance radar of particularly long range and high power (up to 200 miles and 35,000 ft. altitude) has recently been installed at the Paris Regional Control Centre *(Centre de contrôle régional)* at Orly International Airport. The reflector (fig. 1) spans about 10 m. (33 ft.), rotates six times a minute and is largely made of light metal. Up to *twelve panorama scopes* can be connected, as was illustrated in the model shown in Paris (cf. No. 8, 1953, p. 389). *Technical data :* carrier frequency 2,700 to 2,900 mc/s ; pulse recurrence frequency 900 c/s ; pulse duration 1 microsecond ; peak power 600 kW ; current : 127/200 Volt 50-cycle 3-phase a.c.

Surveillance radars of similar design, but with much smaller aerials and less powerful transmitter-receivers are also produced by Thomson-Houston as *SRE sets for GCA installations.* They work in the 3-cm band, have a peak power of up to 100 kW and a range of 50 or 100 km. Their aerials rotate at 12 or 24 r.p.m.

Appreciable progress must finally be reported in *precision landing radar for GCA installations.* They are now as a rule equipped

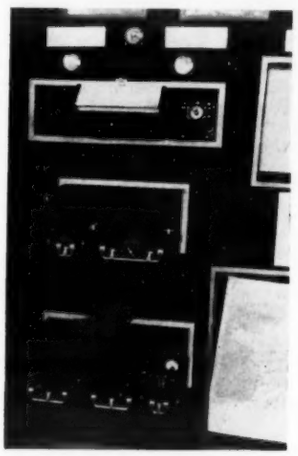


Fig. 4 : Latest version (Mark VII) of the Decca Navigator, built under licence by S.F.R. — Top to bottom : three Deccometers (indicateurs) ; Flight Log (traceur de route) ; normal receiver without Flight Log ; receiver Mark VII (récepteur type VII). — Right, map of the new French Decca chain.

with daylight scopes (fig. 5), doing away with the unpleasant permanent " black-out " hitherto required in control rooms. Working in the 3-cm band, the apparatus employs two flat beams which alternate in a permanent searching motion. The vertical flat beam sweeps space horizontally (bearing) and the horizontal flat beam sweeps space vertically (elevation). The observer sees on a double screen (fig. 6), a luminous point each time the corresponding beam touches the aeroplane. He has thus the bearing of the aeroplane in one point and the elevation in the other. For both images the distance is known.

The complete radar equipment is composed of a transmitting-receiving gear, two aerials, an observation desk and auxiliary gear.

The transmitting-receiving apparatus and the two aerials for bearing and elevation are placed near the field. Their normal position is at 100 m. from the axis of the field, and at 1,000 m. from the landing point. Their presence does not thus constitute a danger

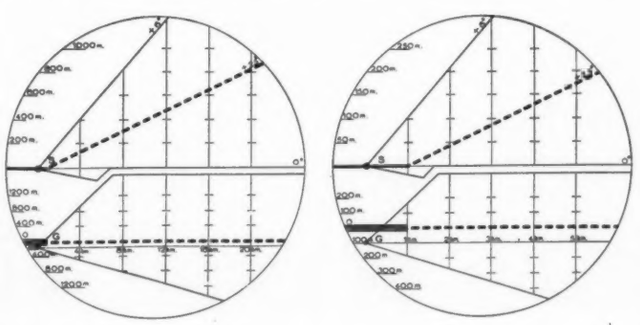


Fig. 6 : Maps on scopes of Thomson-Houston's PAR observer desk. — The left-hand scope covers a range of 20 km., the right-hand scope of only 5 km. ; both scopes show elevation (top) and bearing (bottom) of the approaching aircraft, and its distance.

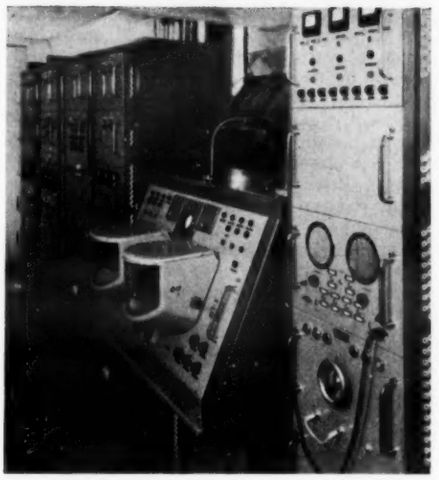


Fig. 5 : Control desk for Thomson-Houston's precision approach radar (PAR element of GCA installation) with daylight scopes ; behind, the four cabinets for the duplicate transmitter-receivers, power units and remote controls. — The desk can be set up at a distance of up to 3000 m. from the rest of the equipment.

during landing. In fixed installations, the transmitting-receiving gear and the two antennae are placed in a small building. The observation desk and its auxiliary gear are placed in the control tower. They are connected to the transmitting-receiving apparatus by underground cables. *Technical data :* Emission frequency : 9,375 ± 10 Mc/s ; peak power : 35 kW ; duration of impulse at 90 % peak power 0.5 ± 0.1 microseconds,

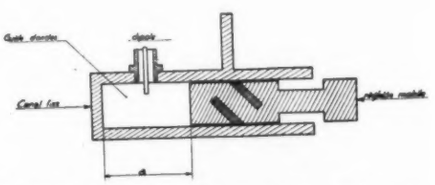


Fig. 7 : The beam of the Thomson-Houston PAR aerials is moved by an electro-mechanical process : backwards and forwards motion of a side face (réglette mobile) of the rectangular wave guide (guide d'ondes) varies the phase law in the dipole series, thus causing the radiation centre line to " squint ".

pulse recurring frequency : 2,000 ± 20 c/s ; beam exploring the elevation : width 3.5°, height 0.6° ; beam exploring the bearing : width 0.6°, height 2° ; space explored in elevation : from —1° to +6° ; space explored in bearing : from 15° beside the landing strip to 5° on the opposite side.

A word here on the *presicion radar's aerials,* which constitute the most original part of the equipment. They are two in number : the horizontal one exploring the bearing, and the vertical one exploring the elevation. A commutator connects them in succession, approximately every second, with the transmitter-receiver, at the same time as the spots on the screen are changed from the bearing distance image to the elevation distance image. Motors controlled from the desk allow the adjustment of the two aerials, each in a plane perpendicular to its thin plane of exploration so as to send the maximum energy towards the aeroplane. *The beam is moved by a combined electro-mechanical process.* Each aerial is composed of a cylindro-parabolic reflector with a line of dipoles

along its focal line. This line of dipoles, 4.4 m. (14 ft. 4 ins.) long, is composed of a waveguide of variable width. When the width varies, by the mechanical movement of one of the small faces (fig. 7), the law of propagation in the guide varies, and so the phase law of the dipoles varies also. The result of this is a change in direction of the emission beam. Instead of oscillating the whole antenna over an alternation of 10 or 20 degrees is is only necessary to displace by a few millimetres the phase control consisting of one of the small faces of the guide.

A double PAR control desk for training purposes (see picture in No. 8, 1953, p. 389) was exhibited at the Paris Show. Using a small control column, which actuates an electrical simulator, the GCA instructor can simulate for his pupil a landing aircraft with all kinds of pilot errors—and check how the student sorts out the mess. The instructor sees the track of the " approaching " point of light on his own scopes. As the two desks are placed only about 6 ft. apart, normal speech is sufficient. When the student has gained sufficient experience on the simulator, he continues his training on the " real " GCA equipment at an airport.

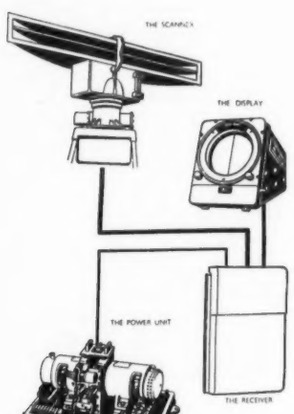


Fig. 8 : Diagram of the fixed storm-warning radar developed by Decca Radar Limited.

● Decca's Storm-Warning Radar

In mid-July the British firm of *Decca Radar Ltd.* announced the introduction of a new airport radar for the detection of storm clouds. Developed at the request of the East African Meteorological Department and designated the *Type 40*, the prototype of this equipment has been in service for some months at Entebbe, Uganda, and has been found to be of great assistance there in weather forecasting for the air routes to South Africa.

The introduction of fast, high-flying commercial aircraft on the world's air routes, and especially the placing in operation of jet airliners, have made a practical form of storm warning virtually indispensable. Even though aircraft as a rule fly above the storm clouds (though in the tropics storm clouds may reach very great altitudes), they have to pass through the lower layers of the atmosphere on take-off and landing. The *Comet* crash near Calcutta (see report on the accident in No. 8, 1953, pp. 411 etc.) would probably not have occurred if the experienced pilot had been warned in time to change his course. The new storm-warning equipment is capable of detecting large storms up to a distance of 100 nautical miles and medium storms up to 80 nautical miles.

Fig. 8 shows a diagram of the equipment. It consists of four basic parts : scanner with transmitter ; receiver ; PPI scope ; power unit.

The *scanner* which rotates continuously at 10 r.p.m., has two separate parabolic reflectors for transmission and reception The *transmitter* (also rotating) is housed in a water-tight container below the reflectors and consists of modulator, magnetron, klystron and a number of amplifiers. The beam transmitted measures 1.2° in the horizontal and 21° in the vertical. *Other characteristics :* carrier frequency 9.320 to 9.500 mc/s ; pulse recurring frequency approx. 500 c/s ; pulse duration 1 microsecond ; peak power 20 kW.

The *receiver* works automatically, without hand operation, and contains the pulse generator for the modulator and the power pack for the P.P.I. scope. It can be fixed to a wall separately from the rest of the equipment.

The *display unit* is housed in a light metal casing, is 12 inches (30 cm.) in diameter and is marked with concentric rings representing distances of 5 and 10 nautical miles. The rim is graduated in degrees and has a radial trace for true North. Accuracy of plotting ± 1° ; of distance 3 %.

The *power unit* consists of a 1 kW electromotor and an alternating current generator with voltage regulation.—*Weight of all four elements · 712 lbs. (322 kg.).*

● Ultra Electric Miniature Homing Transmitter for Mae Wests

A new emergency beacon with the neo-Biblical name of *SARAH* was exhibited for the first time at the Paris Show and should arouse interest in aviation circles throughout the world. The following description of this equipment has been written for us by *James Hay Stevens*, London.

*

SARAH, that is, *S*earch *A*nd *R*escue *A*nd *H*oming equipment, is a new radar-frequency personnel beacon designed and manufactured by Ultra Electric Ltd. of London.

Both during and since the War an elaborate air-sea-rescue organization has existed in Great Britain which, being an island, is particularly prone to disappearances at sea, since an aeroplane may leave the coast in cloud whichever direction it is headed. It has long been realized that the success of a visual search is as much a matter of luck as it is of diligence, even in the best weather—while at night or in bad weather it is virtually hopeless. There is the further factor that in northern waters, particularly in the North Sea in winter, even a successful search may only retrieve a corpse, since survival time, with the best of clothing, is a matter of a few hours, or even minutes.

Design of *SARAH* was based on making a transmitter beacon small and light enough to be fitted into a Mae West, which would give a continuous signal for a longer period than the wearer was likely to survive. The beacon had to have a wide range homing signal and also be capable of giving a fix to within a few feet. Individual identification, so that several signals in an area will not confuse searchers, was another requirement and the R.A.F. insisted on two-way voice communication.

Fig. 9 : Left, the simple Ultra Electric SARAH emergency homing beacon, consisting of transmitter and battery ; right, the extended apparatus with microphone receiver for two-way conversations added.

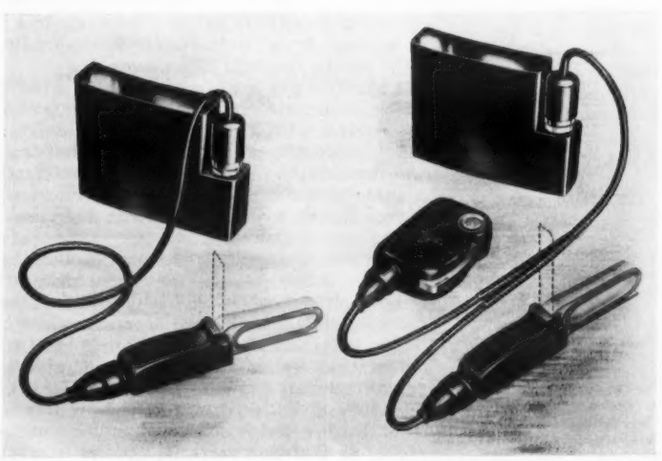
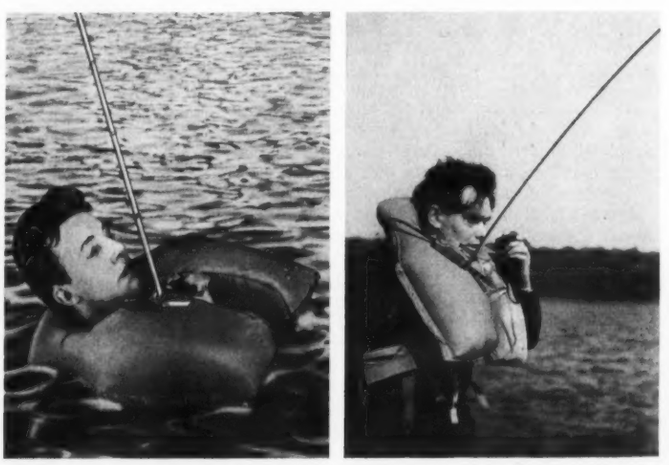


Fig. 10 : Left, the simple SARAH apparatus in use (removal of protective cover opens aerial and switches on transmitter). Right, a crewman talking to the search aircraft through SARAH's hand two-way R/T set (microphone/receiver) ; battery under right arm ; aerial length 31 inches.



These rigorous requirements have been met after some three year's work under the direction of Mr. H. G. Sturgeon, Ultra's Chief Engineer. The radar-frequency beacon is a marvel of miniaturising, being a pack 7 in. by 1 in. by 1 in. and weighing only 6 oz.—including the steel tape aerial, which occupies half of the small container (see *left* side of Figs. 9 and 10). This aerial is made from laminations of spring steel, similar to that of a pocket rule, which yield to overloads, such as the breaking of waves or gusts of wind. Removal of the casing switches on the set; originally an immersion switch was considered, but it was later felt that any man too exhausted to remove the cover would be unlikely to survive anyway. An advantage of having a manual switch is that in a dinghy a crew can extend the time of transmission by using one set at a time.

The power supply is a pocket battery weighing 2 lb. and measuring 6 in. by 4½ in. by 1 in., which has a life at 75 % power of 20 hours. The equipment is completed by about 2 oz. of cable. The hand microphone/receiver (see *right* side of Figs. 9 and 10) is optional, weighs 12 oz. and measures 4 in. by 2½ in. by 1¼ in. The whole equipment therefore weighs about 3¼ lb.

The minute valves and other parts of the set are moulded solid in plastic to insure complete waterproofness and resistance to shock. All cables and terminals are, of course, completely waterproof. The whole equipment is designed to withstand over 50 g. Operating temperature range is —50°C. to +70°C.

The effect of the beacon (Fig. 11) is to give the man in the sea an apparent size of a 120-mile circle from a hight of 10,000 ft.—or a 12-mile circle to a ship with its antennae 40 ft. above sea level. A 30 degree " silence " cone above the transmitter concentrates the target to 200 ft. in diameter at 500 ft. and makes it possible for a boat or helicopter to be brought to within 10 ft. of the aerial. This precision in the final stages has been proved to be absolutely essential for rescue under North Sea winter conditions where a bobbing object is often impossible to detect for more than 10 yards. Search can be carried out at 211 attainable altitudes; in general greater ranges being achieved at greater heights.

The beacon transmits a coded pulse (of 7 microseconds duration, approx. 16 kW peak power) that is generated in an optimized squegging oscillator with a repeating regime which is controlled to provide groups of pulses at a low repetition frequency (every 100 microseconds—300 microseconds). This type of transmission gives the effect of a continuous signal, but reduces the battery drain to a minimum. Each transmitter is pre-set by the manufacturer to give it an individual pattern.

Speech modulation is by pulse repetition frequency variation of a 6,000 pulse per second signal. This gives about a quarter (approx. 4W) of the peak power of the beacon mode, but since this is only based on the final run-in, the shortened range is immaterial. The selector switch on the microphone/receiver is spring-loaded to the " beacon " position to prevent inadvertent loss of beacon signal. The battery capacity gives one hour in the voice transmit/receive mode in addition to 19 hours on the beacon.

The " body " hears by amplitude-modulated carrier wave from the rescue craft by

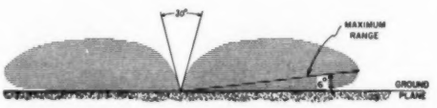


Fig. 11 : Radiation diagram of the SARAH emergency beacon and its cone of silence.

means of a super-regenerative receiver with a squegging rate of some 60 kilocycles (fig. 7). The receiver transmits a small characteristic through the beacon antenna which shows on the rescuer's cathode-ray tube display, so that he can tell when his instructions are being listened to. All beacons can be received by the rescue equipment, but, in order to avoid confusion, they are not compatible with each other and so the " bodies " cannot hold conversations.

A special type of receiver is required to make contact with and locate the beacons. This is not as serious as it might sound, since the wide range of the equipment and its ability to handle several signals at once means that relatively few aircraft need to be equipped to cover an area like the North Sea. Since helicopters are an essential feature of an air-sea-rescue organization and their fuel/pay load is generally poor a special sub-miniaturized receiver has been developed for them. Figure 12 shows both the standard search receiver, with its power pack and the sub-miniaturized combined receiver and power pack. The standard receiver weighs 18 lb. and its power pack 6 lb., the dimensions being 12 in. by 8 in. by 10 in. and 10 in. by 7 in. by 7 ½ in. respectively. The sub-miniaturized unit weighs 10 lb. and 12 ½ in. by 3 ½ in. by 6 in.

The receiver is used with port and starboard di-pole aerials, similar to the Rebecca antennae, which, by a time-sharing system, display port and starboards spikes on the cathode ray tube. The forward inclination of the antenna patterns and the overlap are shown diagrammatically in Fig. 13. The first pulse which reaches the receiver produces a linear vertical trace, thereafter the pulses deflect the trace in accordance with the aerial on which they are received. The spike is re-written in the same place since each pulse group is the same. When searching prior to receipt of a signal the receiver tuning is scanned over a ± megacycle band to insure that no signal is missed through mistuning.

Upon receipt of a signal and the appearance of the first spike the aircraft is headed toward the signal and height is reduced. At first there will be a spike on one side of the trace, but this will later be replaced by a pair as the antenna overlap proves the heading. Manual adjustment of the gain control brings in a range indication to warn the operators that the " null " area of the fix is being approached. Speech from the beacon modifies the trace as well as being heard through the receiver head set. The search equipment includes a 2 watt voice-amplitude modulated C.W. transmitter for contact with the beacon.

The shipboard homing antenna, the one used for the final run-in if no helicopter is available, is a servo-positioned Adcock type, Fig. 11. The antenna is positioned by the operator to get the beacon bearing and it then swings automatically back and forth a small degree about the null area. For sea search a different array is also available. The shipboard homing antenna is portable and need only be erected when required.

The company has received contracts to produce equipment for the R.A.F., and sets may be available to civil pilots.

Last winter Mr. Sturgeon demonstrated *SARAH* to the RCAF with such success that this service too may adopt it. An account of the test and the result achieved, as told to the writer by Mr. Sturgeon himself, is of some interest.

Fig. 12 : Receiver (left) and its power unit (centre) for large search aircraft and ships, compared with a miniature combined power unit and receiver for rescue helicopters (right) Both receiving units were developed by Ultra Electric.

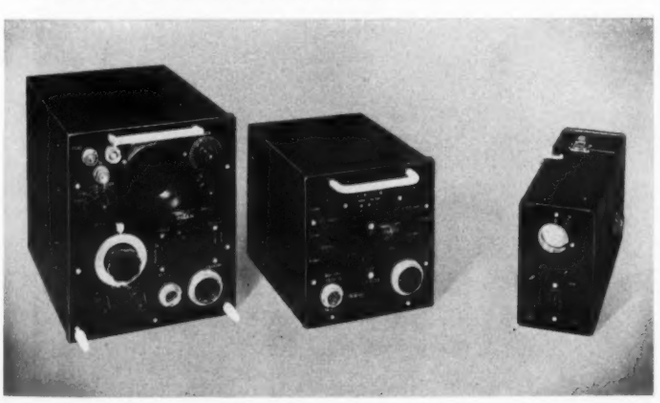


Fig. 13 : Diagram of the search and homing aerials in the rescue aircraft, which respond to the signals emitted by the minute SARAH set.

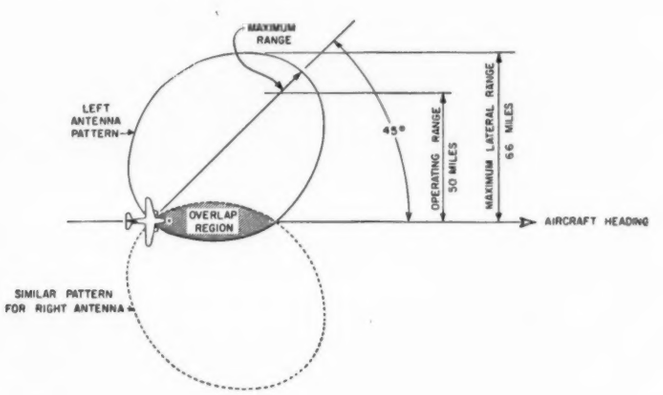


Fig. 14 : Servo-positioned Adcock-type homing array for ships and life boats.

The area chosen was the wild country of a thousand lakes in the north of Ontario Province. In this area, an aeroplane can crash and the personnel be lost for weeks. In mid-winter, however, the frozen lakes present so many landing areas that there could be no guessing where the test aeroplane might have put down.

Mr. Sturgeon, with his beacon, was flown off in an RCAF Beech UC-45 *Expediter*, which was flight planned from Ottawa to North Bay. It was then deliberately flown off course and landed on Smoke Lake. The search aircraft was sent out from Ottawa with the task of searching 20,000 square miles in which the *Expediter* might have come down before its fuel was exhausted. The weather was ideal for the test : 8/8 clouds up to 13,000 ft.—and the search was flown *above* the cloud.

Presuming that the *Expediter* could have been off course by some twenty degrees there was a fan-shaped area to search. A centre line course was sufficient for the first part until the area became more than 120 miles wide, after which a species of creeping-line-ahead sweep was planned. Actually, the beacon was picked up on the first right-angled leg off the true course. The rescue pilot homed on the beacon, was heard passing overhead by Sturgeon, made a reciprocal to check the fix, and the two were talking within 15 minutes of the first blip appearing on the cathode ray tube. To heighten the realism, this all took place in a blizzard !

SARAH is well suited to the vast trackless spaces of Canada. It has also been adopted by The Grumman Aircraft Corp. for its test-pilot team. These pilots have to do a good deal of flying over the sea, when testing naval aeroplanes and amphibians. Incidentally, *SARAH* overcomes that tricky blind spot in seaplane rescue between air sighting and surface sighting after alighting. At the time of writing, only the allocation of a frequency by the CAA prevented the system being put into operation.

Ultra Electric is represented in the USA by its associate, Simmonds Aerocessories Inc., who would be likely to manufacture in the event of large trans-Atlantic orders.

As a pilot, the writer would certainly feel much happier flying with *SARAH* in his Mae West when crossing the sea in a single-engined light aeroplane. The carrying of the beacon and the use of equipped search aircraft would undoubtedly have saved the life of the late Tom Hayhow, when he came to grief in the Central European forests last spring. The situation then was almost identical with the Canadian test, and hundreds of hours of flying failed to locate the aeroplane—and its then uninjured pilot.

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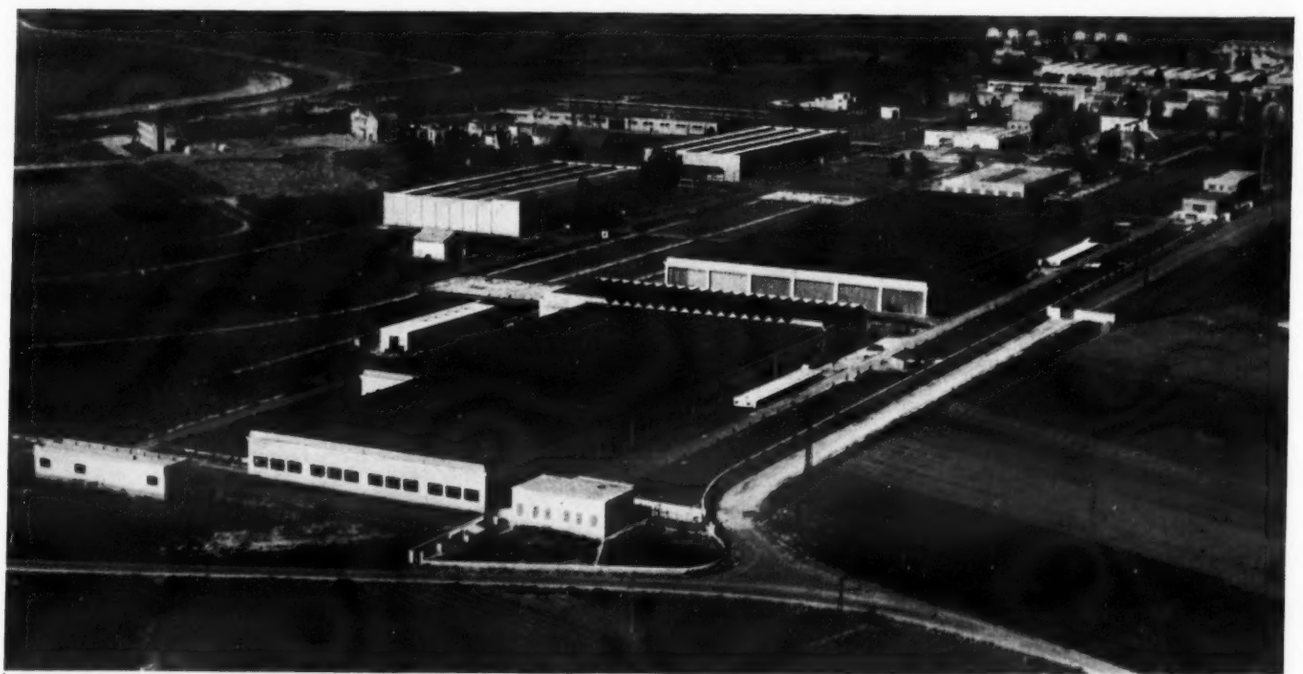

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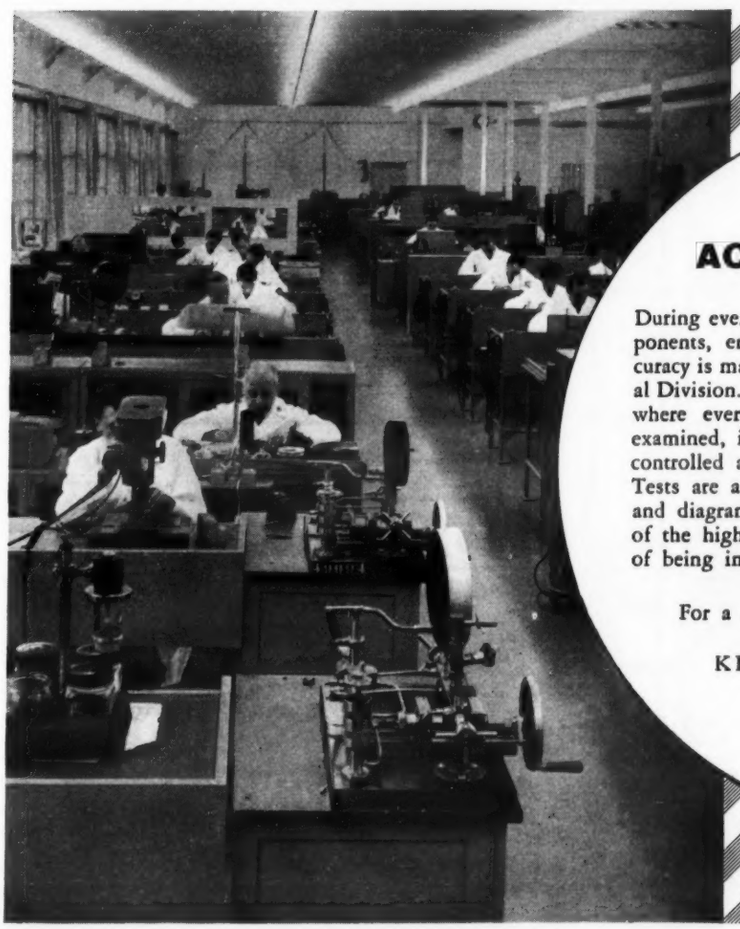

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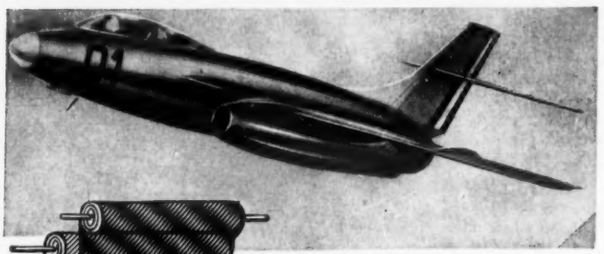

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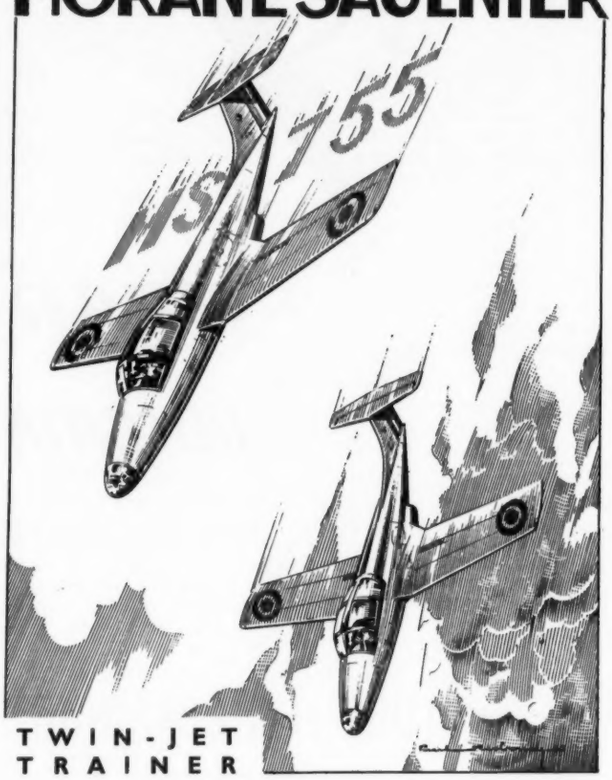

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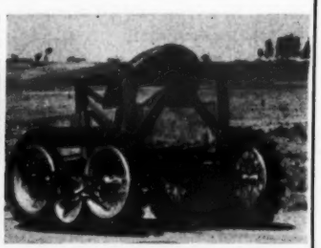

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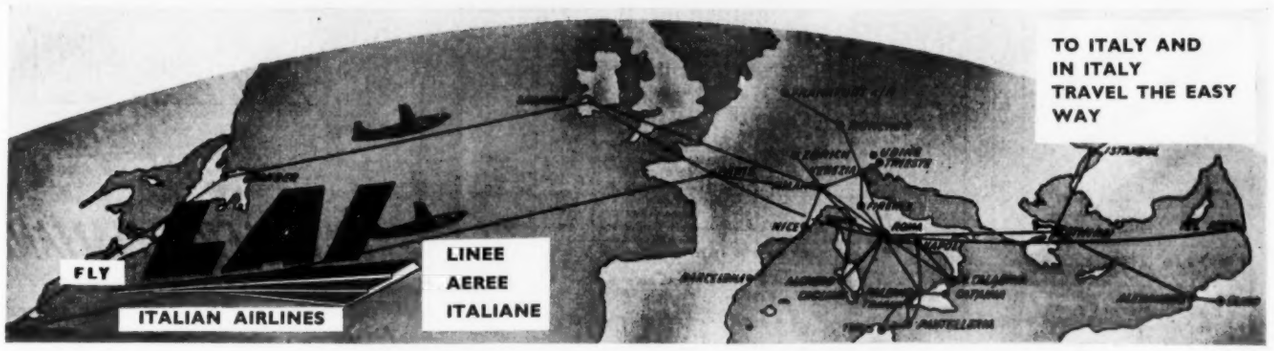

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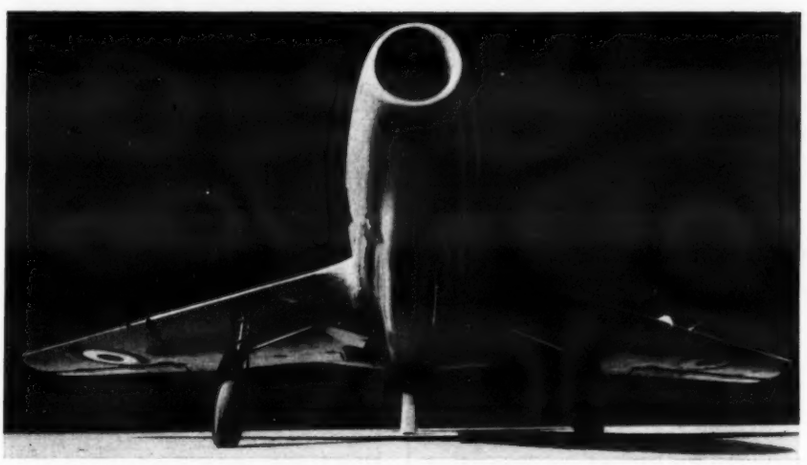

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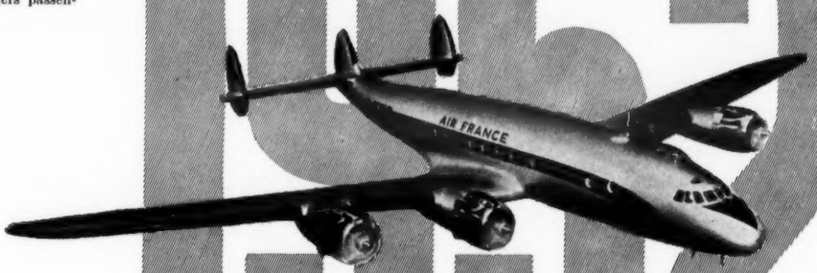
With each succeeding year Air France is consolidating its position on the world market through its constantly expanding route network, its high standard of maintenance, the comfort and service it offers passengers.

1952



A constructive year, as the following facts show

The opening of several new routes brought Air France's network up to 250,000 kilometres.

APRIL :	Opening of the Paris-Mexico City service.
NOVEMBER :	Paris-Tokyo in 37 hours 30 minutes flying time by "Constellation".
DECEMBER :	Installation of sky lounge chairs on one of the Paris-Casablanca services. New luxury service to Dakar.
JANUARY 1953 :	Air France opened the Paris-Caracas-Bogota service.

Air France is doing its utmost to bring the aircraft within reach of all :

— *" tourist class " has been introduced on some routes.*
— *major reductions have been agreed to on others.*

Air France is constantly improving and modernizing its fleet. During 1952, the famous Lockheed "Constellation", nicknamed the "Atlantic favourite", came into general use on the principal routes.

"Super Constellations", Vickers "Viscounts", de Havilland "Comets" and Bréguet "Deux-Ponts" have been ordered and will be put into service in 1953.

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On July 8th, 1952, Mr. Neeland, a representative of the U.S. Civil Aeronautics Administration handed over to Air France the certificate awarded by C.A.A. to the workshops of the Overhaul Centre and Maintenance Service at Orly. Operational Centre. A similar certificate was awarded to the Courbevoie engine overhaul centre in October 1951. Air France is one of the few companies to hold this Civil Aeronautics Administration certificate.

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On completing the voyage, cargo samples of the fuel are checked for quality just before off-loading into ocean terminal storage tanks.

Product samples from the ocean terminal are subjected to a quality analysis; from the ocean terminal the product may go through an inland storage depot or directly to airfield storage.

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